

THE IDENTIFICATION OF CONIFERS

BY

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Veitch Memorial Medallist, 1923.

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FOREWORD

This little book is the outcome of a request for a portable volume, the main object of which would be to help forestry students and others to identify in the field the conifers most likely to be met with in cultivation. The analytical keys are based on those constructed by the late Augustine Henry, who was one of the first to introduce a practical method of identifying conifers from their leafy shoots. Following the lines of Dallimore and Jackson's *Handbook of Coniferæ*, the book is intended to be an introduction to that work. The illustrations are from the careful and accurate drawings prepared for the *Handbook* by my friend Miss G. Lister, whose advice and criticism have been invaluable.

The list of noteworthy trees mentioned under each species is largely based on the statistical returns published by the Royal Horticultural Society in their Report of the Conifer Conference held in 1931¹ and on lists made by the author during personal visits to many of the estates named. In the great majority of cases, the dimensions of the trees have been taken with Stanley's apomecometer, the girth measurements being at 5 ft. unless otherwise stated. The difficulty of keeping such a list up to date is obvious, but the latest dates are added in brackets. The measurements given in the description of each species refer to the dimensions attained by the tree in its native country.

The nomenclature, with a few exceptions, follows the 1938 *Hand List of Coniferæ* issued by the Royal Botanical Gardens at Kew, in which the names adopted are in accordance with the International Rules of Botanical Nomenclature. This has unfortunately involved the

¹ *Conifers in Cultivation*, edited by F. J. Chittenden, 1932.

rejection of a number of names hitherto in common use, but in all cases the better known names have been cited as synonyms. A few rare and tender conifers only occasionally met with in the milder parts of the country, such as Cornwall and Ireland, are omitted. The arrangement of the species is alphabetical within each genus.

I shall be glad to name specimens sent to me for identification at 3, The Avenue, Kew Gardens, but the material forwarded should be representative.

A. BRUCE JACKSON.

July 1945.

CONTENTS

	PAGE
FOREWORD	v
GENERAL CHARACTERS OF CONIFERÆ	1
OUTLINES OF CLASSIFICATION	4
NOTES ON THE USE OF THE KEYS	7
ARTIFICIAL KEY TO THE GENERA OF CONIFERÆ	8
DESCRIPTION OF GENERA AND SPECIES:	
TAXACEÆ	11
PINACEÆ	22
CUPRESSACEÆ	116
GINKGOACEÆ	146
INDEX	148

THE IDENTIFICATION OF CONIFERS

GENERAL CHARACTERS OF CONIFERÆ

The Seedling Plant. Seedling conifers vary in the number, form and size of the cotyledons or seed-leaves. The latter usually appear above-ground, but in the genus *Araucaria* two forms of germination occur, one in which the four seed-leaves are raised upon a well-marked stalk, the other in which the seed-leaves do not appear above the surface of the soil but remain enclosed within the seed-coat, as in *A. araucana* (the common monkey puzzle). In the genera *Torreya* and *Keteleeria* the cotyledons also remain enclosed within the seed-coat. In the *Cupressaceæ* and *Taxaceæ* the number of cotyledons rarely exceeds two. In *Pinus* and *Abies* the number is variable, ranging from three or four in *Pinus contorta* to six to eight in *P. sylvestris* and fifteen or more in *P. Sabiniana*.

Buds and Young Shoots. A usual feature in the development of the leading shoot is a terminal bud surrounded by smaller buds. The shape and size of the winter buds and bud-scales and their resinous or non-resinous character often afford good specific distinctions, especially in *Abies* and *Pinus*, but such characters refer only to the resting stage during the winter months. The young shoots vary greatly in colour and degree of hairiness, features which often furnish reliable means of identification. In *Larix*, *Pseudolarix* and *Cedrus* two kinds of shoots are produced; long slender shoots in which the leaves are spirally arranged, and short lateral spurs with reduced internodes bearing the leaves in apparent clusters.

Foliage. The leaves, which are usually evergreen, vary

considerably in the different genera. They may be ovate, needle-like, flat and linear, or they may assume the form of adpressed scales. In many cases the juvenile leaves differ in form, attachment or arrangement from those on the adult tree. The mesophyll or spongy tissue of the leaf is traversed by one or more vascular bundles, and usually by resin canals¹ whose number and position are often well defined and in some genera such as *Abies* may afford useful diagnostic characters. The surface of the leaf is perforated with stomata which are breathing pores or apertures surrounded by guard cells leading into an intercellular space below. In *Pinus*, *Picea* and *Abies* the stomata are disposed in longitudinal bands on one or both surfaces, their position being indicated by white dots of glaucous bloom.

Flowers. The male flowers in conifers are arranged in more or less compact clusters or catkins and the female flowers are usually clustered to form a cone. In a typical female cone such as *Pinus* or *Abies* we may assume that each flower consists of an ovule-bearing scale (the carpel cone-scale) borne in the axil of a bract. In *Pinus* and some other genera the bract soon ceases to grow and at maturity is hidden by the much larger cone-scale. The ovules are not, as in Angiosperms, enclosed in an ovary but are exposed on the upper surface of the scales. Conifers thus belong to the great division of Seed plants known as Gymnosperms. The number of ovules is usually two, but varies considerably in different genera. The seeds are frequently winged, which enables them to be dispersed by the wind.

Wood. The wood is distinguished from that of Angiosperms by the absence of vessels, and is composed of tracheids or elongated spindle-shaped cells with closed

¹ Only visible with the aid of a lens magnifying 8 diameters.

ends which are dovetailed between one another. They have woody walls marked with bordered pits which are a characteristic feature of coniferous woods. The medullary rays traversing the wood are usually only one cell thick and are rarely visible without a lens. In some genera (as in *Pinus*) resin ducts may be seen as minute dots in a transverse section of the wood. The distinction between spring and autumn wood is usually well marked in trees from temperate regions. Heart-wood and sap-wood are not always well defined.

OUTLINES OF CLASSIFICATION

Family Taxaceæ

Evergreen trees or shrubs. Leaves alternate, rarely opposite, often two-ranked, usually needle-like or scale-like. Flowers mostly dioecious. Male inflorescence catkin-like with the stamens consisting of peltate scales bearing two or more pollen sacs. Cone formation imperfect in the female inflorescence. Carpels few or reduced to one, each with 1-2 ovules. Fruit consisting of a seed with a bony shell, partly or wholly surrounded by a fleshy aril (*Taxus* and *Torreya*) or drupaceous testa (*Cephalotaxus*) or borne on a fleshy receptacle or enlarged stalk (*Podocarpus*). Cotyledons two. Twelve genera, including about 100 species in the temperate, subtropical and tropical regions of both hemispheres¹; sometimes divided into three families, Taxaceæ, Cephalotaxaceæ and Podocarpaceæ.

Tribe 1—Taxeæ, p. 4.

„ 2—Podocarpeæ, p. 5.

TRIBE 1—TAXEÆ

Seed partially or completely surrounded by a fleshy cup-like aril or with a fleshy resinous outer seed-coat. Anther cells 2-9; pollen grains wingless.

GENERA : *Cephalotaxus*, p. 11.

Torreya, p. 13.

Taxus, p. 15.

¹ A monograph of the family by Pilger appears in *Das Pflanzenreich*, IV, pt. 5 (1903).

TRIBE 2—PODOCARPEÆ

Seed with a dry outer coat, surrounded by a fleshy cup-like aril, or supported by a fleshy bract and stalk. Anther cells 2; pollen grains winged, or wingless in Saxegothæa.

GENERA: Podocarpus, p. 17.

Saxegothæa, p. 19.

Family Pinaceæ

Evergreen or rarely deciduous trees or shrubs with usually whorled branches. Leaves linear, lanceolate or scale-like, spirally arranged. Flowers usually monœcious. Male flowers borne in short catkins consisting of numerous scales bearing the pollen sacs on their underside. Fruit a woody cone with winged seeds. Cotyledons usually more than two. About 20 genera, including some 270 species, occurring chiefly in the temperate and sub-tropical regions of both hemispheres.

Tribe 1—Abietinæ, p. 5.

„ 2—Taxodineæ, p. 6.

„ 3—Araucarineæ, p. 6.

TRIBE 1—ABIETINÆ

Trees with adult leaves linear, spirally arranged, though often apparently in two or more rows, or in tufts (*Pinus*, *Larix* and *Cedrus*). Bud-scales scarious. Flowers monœcious. Cones with spirally arranged woody scales, the bracts often remaining small, separate from the scales except at the base. Seeds two to each scale, winged.

GENERA: *Abies*, p. 22.

Keteleeria, p. 41.

Picea, p. 41.

Pinus, p. 55.

Larix, p. 83.

Pseudolarix, p. 88.

OUTLINES OF CLASSIFICATION

GENERA : Cedrus, p. 88.
Pseudotsuga, p. 93.
Tsuga, p. 96.

TRIBE 2—TAXODINEÆ

Leaves linear or scale-like, spirally arranged. Bud-scales green. Flowers monœcious. Cone-scales spirally arranged, woody. Bracts more or less united with the cone-scales. Seeds 2-6 to each scale.

GENERA : Cunninghamia, p. 101.
Cryptomeria, p. 108.
Sequoia, p. 105.
Athrotaxis, p. 107.
Sciadopitys, p. 111.
Taxodium, p. 111.

TRIBE 3—ARAUCARINEÆ

Leaves spirally arranged, broad or narrow. Bud-scales green. Cones globular; scales numerous, spirally arranged, each bearing a single completely adnate seed.

GENUS : Araucaria, p. 114.

Family Cupressaceæ

Adult leaves mostly scale-like, sometimes acicular and subulate, opposite or in whorls of three. Cone-scales woody in fruit, or fused into a berry-like cone (Juniperus). Seeds one to many, often winged. About 15 genera, including over 100 species.

GENERA : Fitzroya, p. 116.
Cupressus, p. 116.
Libocedrus, p. 129.
Thuja, p. 131.
Juniperus, p. 137.

NOTES ON THE USE OF THE KEYS

The following Key, based on well-marked characteristics of shoots, winter buds and foliage, will enable the beginner to identify the genus of any conifer he is likely to meet with in cultivation, and should be used in conjunction with the keys to the species which will be found under the respective genera. The keys are intended to be used with specimens having mature foliage taken from well-developed lateral branches. The diagnostic characters should be easily distinguished with the naked eye or with the help of a pocket lens magnifying 8 diameters. It is important to note that the characters based on buds and bud-scales are only available during the autumn and winter months when they are in the resting stage.

The foliage of quite a number of Conifers possesses a characteristic odour when bruised or rubbed, which often affords a useful diagnostic character. The branchlets of all forms of the Savin (*Juniperus Sabina*) have a strong rank smell and can be distinguished from other Junipers by this character. *Cupressus nootkatensis*, *Torreya californica* and *T. nucifera* are also rank smelling. *Abies grandis*, *Thuja plicata* and *T. occidentalis* have aromatic foliage, especially in warm weather. The cut shoots of *Abies amabilis* have an odour similar to that of tangerine orange, while the foliage of the Douglas Fir (*Pseudotsuga taxifolia*) has a pineapple-like scent. The leaves of the Colorado Douglas Fir (*P. glauca*) are said to smell like turpentine.

USE OF THE KEYS

ARTIFICIAL KEY TO THE GENERA OF CONIFERÆ
CULTIVATED IN GREAT BRITAIN

- A. Leaves needle-like, in clusters or whorls SECTION I
- AA. Leaves not in clusters or whorls,¹ spirally arranged or opposite.
 - B. Leaves linear, linear-lanceolate or needle-like.
 - C. Winter buds with scarious scales. Leaf-scars conspicuous SECTION II
 - CC. Winter buds with green scales. Leaf-scars inconspicuous.
 - D. Leaves less than 25 mm. long SECTION III
 - DD. Leaves more than 25 mm. long SECTION IV
 - BB. Leaves not linear (except in juvenile foliage of *Cryptomeria japonica*) (Section VI).
 - C. Leaves small and usually scale-like, opposite or whorled. Cones with few scales SECTION V
 - CC. Leaves narrow, often curved, spirally arranged SECTION VI
 - CCC. Leaves broad, ovate, spirally arranged SECTION VII

SECTION I

- A. Leaves 2, 3 or 5 in a cluster, 2.5 cm. or more long *Pinus* (Figs. 20 and 21)
- AA. Leaves arranged in two ways, scattered on long shoots and clustered on short shoots *Cedrus* (Fig. 26)
- B. Leaves deciduous.
 - C. Bud-scales acuminate, staminate flowers clustered *Pseudolarix* (Fig. 25)
 - CC. Bud-scales obtuse, staminate flowers solitary *Larix* (Fig. 24)
- BB. Leaves evergreen *Cedrus* (Fig. 26)
- AAA. Leaves completely connate in pairs, 5-10 cm. long, which are arranged in whorls of 10 to 30 *Sciadopitys* (Fig. 34)

SECTION II

- A. Main branches not whorled. Leaves shortly stalked, the stalks adpressed to the shoot *Tsuga* (Fig. 28)
- AA. Main branches usually whorled. Leaves indistinctly stalked or sessile.
 - B. Leaf-scars peg-like. Cones pendulous, with persistent scales *Picea* (Fig. 18)
 - BB. Leaf-scars disc-like. Cones erect, with deciduous scales *Abies* (Fig. 9)
 - BBB. Leaf-scars slightly prominent, oval. Buds fusiform. Foliage fragrant when rubbed. Cones with persistent scales. Bracts 3-lobed with the central lobe spine-like. *Pseudotsuga* (Fig. 27)

¹ Except in *Fitzroya* and some *Junipers*, where they are in whorls of three.

SECTION III

- A. Leaves needle-like, opposite or in whorls of three
Juniperus (in part)
- AA. Leaves linear, distinctly two-ranked.
- B. Leaves evergreen, dark green above.
- C. Bud-scales rounded. Leaves yellowish green beneath
Taxus (Fig. 3)
- CC. Bud-scales acute. Leaves glaucous beneath.
- D. Tree with thick spongy bark. Leaves smaller near the base of the shoot, grading into bud-scales
Sequoia sempervirens (Fig. 31)
- DD. Shrub or small tree, bark not spongy.
- E. Leaves obtuse, 6-12 mm. long
Podocarpus alpinus
- EE. Leaves abruptly pointed 12-25 mm. long
Podocarpus andinus
- BB. Leaves deciduous, light green
Taxodium (Fig. 35)
- AAA. Leaves indistinctly two-ranked, dark green above, paler with 2 broad stomatic bands beneath, slightly twisted
Saxegothaea (Fig. 5)

SECTION IV

- A. Leaves dark green, linear or linear lanceolate, two-ranked.
- B. Buds with rounded scales
Keteleeria
- BB. Bud-scales acute
- C. Leaves narrowing gradually to the base, 5-10 cm. long, stomata forming two broad bands on the under-surface
Podocarpus salignus (Fig. 4)
- CC. Leaves rather abruptly narrowed into a short petiole.
- D. Stomata in 2 narrow grooves on lower surface
Torreya (Fig. 2)
- DD. Stomata forming 2 broad bands on lower surface
Cephalotaxus (Fig. 1)
- AA. Leaves light green, twisted into more or less opposite ranks, narrowly lanceolate; upper surface with 2 very narrow bands of stomata, lower surface with 2 broad bands of stomata
Cunninghamia (Fig. 29)

SECTION V

- A. Foliage arranged in flattened sprays. Leaves in opposite pairs, scale-like.
- B. Cones oblong, woody, with the scales overlapping.
- C. Foliage aromatic when rubbed (usually). cone scales 8-12
Thuja (Fig. 44)
- CC. Foliage not aromatic. Cone scales 6
Libocedrus (Fig. 41)
- BB. Cones sub-globose, woody, with scales valvate, peltate
Cupressus (in part)

I.C.

B

AA. Foliage not arranged in flattened sprays.

B. Leaves oblong, in whorls of 3. Cones 6-8 mm. diam. with 2-3 rows of whorled scales of which only the upper are fertile
Fitzroya (Fig. 36)

BB. Leaves scale-like in opposite pairs.

C. Cones woody, globular, 6 mm. diam. or more with peltate scales, all of which bear seeds . . . *Cupressus* (in part)

CC. Cones fleshy, berry-like. Both scale-like and needle-like leaves often borne on the same plant

Juniperus (Fig. 45)

SECTION VI

A. Mature foliage strongly keeled, ascending : juvenile foliage flattened linear, widely spreading. Cone scales longer than broad

Cryptomeria japonica (Fig. 30)

AA. Mature foliage keeled, strongly incurved ; juvenile foliage keeled, widely spreading. (Not hardy) . . . *Araucaria excelsa*

AAA. Foliage not, or only slightly keeled.

B. Cone-scales longer than broad. Bark thin

Athrotaxis (Fig. 33)

BB. Cone-scales broader than long. Bark spongy

Sequoia Wellingtonia (Fig. 32)

SECTION VII

Leaves broad, crowded 2.5-5 cm. long, up to 2.5 cm. wide

Araucaria araucana

TAXACEÆ

CEPHALOTAXUS Siebold and Zuccarini

Leaves linear, erect, or spreading in two ranks, with two broad white bands of stomata beneath and prominent midrib above. Male flowers in globular heads in the axils of the leaves. Female flowers consisting of several pairs of two-ovuled carpels. Seed olive-like with a fleshy coat. Five species in E. Asia.

KEY TO CEPHALOTAXUS

Leaves semi-erect, abruptly pointed, 2-5 cm. long. *C. drupacea*¹
Leaves horizontally spreading, tapering to a fine point, 5-8 cm. long *C. Fortunei*

Cephalotaxus drupacea Siebold and Zuccarini. Central China, 1000-3000 ft. alt. Japan. Introduced in 1830. (Fig. 1.)

A low bushy tree or shrub. Commonly cultivated.

Cephalotaxus Fortunei Hooker. Central China.

Tree 30 ft. high. Introduced in 1848. In cultivation an irregularly branched shrub.

NOTEWORTHY SPECIMEN :

England. Isle of Wight : Binstead, 25 ft.

¹ The var. *pedunculata* Miquel (*Taxus Harringtoniana* Knight) is almost intermediate between *C. drupacea* and *C. Fortunei* in foliage ; but the male flowers are in branched heads with the stalk 1-2 cm. long. Known only in cultivation.

Dacrydium Franklini Hook. fil. The Huon Pine. Tasmania. With small slender drooping branches and scale-like leaves ; may occasionally be seen in Cornish gardens and also in the West of Scotland. Introduced before 1850.

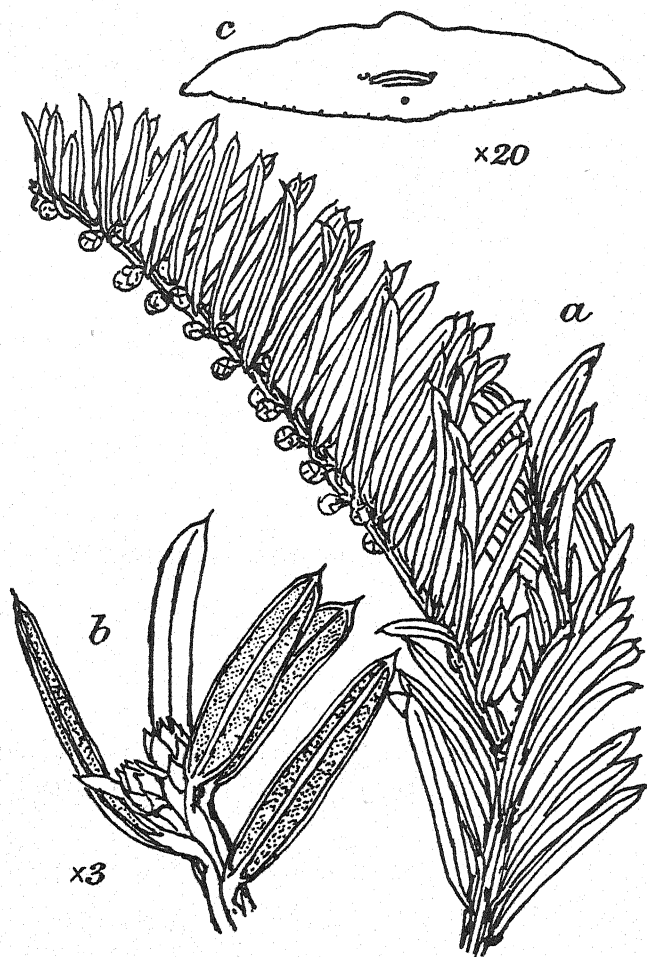


FIG. 1.—*CEPHALOTAXUS DRUPACEA*.
a, shoot with young male flowers; *b*, leaf-buds and under-surface of leaves; *c*, section of leaf.

TORREYA Arnott

Leaves linear, spine-pointed, two-ranked, with two grooves on the lower surface, the midrib not evident on the upper surface. Foliage emitting a pungent odour when crushed. Male flowers solitary, axillary, ellipsoid to oblong. Female flowers reduced to a single ovule. Seed sessile or subsessile, completely surrounded by a thin fleshy aril. Five species; N. America and E. Asia.

KEY TO TORREYA

- A. Leaves 30-60 mm. long, glaucous beneath with slightly depressed narrow stomatic bands *T. californica*
AA. Leaves 20-30 mm. long, green beneath with deeply depressed stomatic bands *T. nucifera*

Torreya californica Torrey. California Nutmeg (Fig. 2.)

Tree attaining 100 ft. in height. Introduced in 1851 by Wm. Lobb. A handsome conifer of pyramidal habit with slender branches, becoming round-topped with age. The best specimens are found in the west of England, where the climate is moist.

NOTEWORTHY SPECIMENS :

- England.* Cornwall: Tregothnan, 55 ft.; Coldrinnick, 50 ft.; Scorrier, 40 ft. x 6 ft. *Glos.*: Westons-birt, 40 ft. *Herts.*: Poles, Ware, 65 ft. (1944).
Ireland. Co. Down: Castlewellan, 38 ft.

Torreya nucifera Siebold and Zuccarini. Japan.

Tree 36-80 ft. high. Introduced before 1764. In this country usually seen only as a shrub.

NOTEWORTHY SPECIMENS :

- England.* Hants: Exbury, 12 ft. *Glos.*: Westons-birt, 25 ft. (1945).
Ireland. Co. Meath: Headfort, Kells, 8 ft.

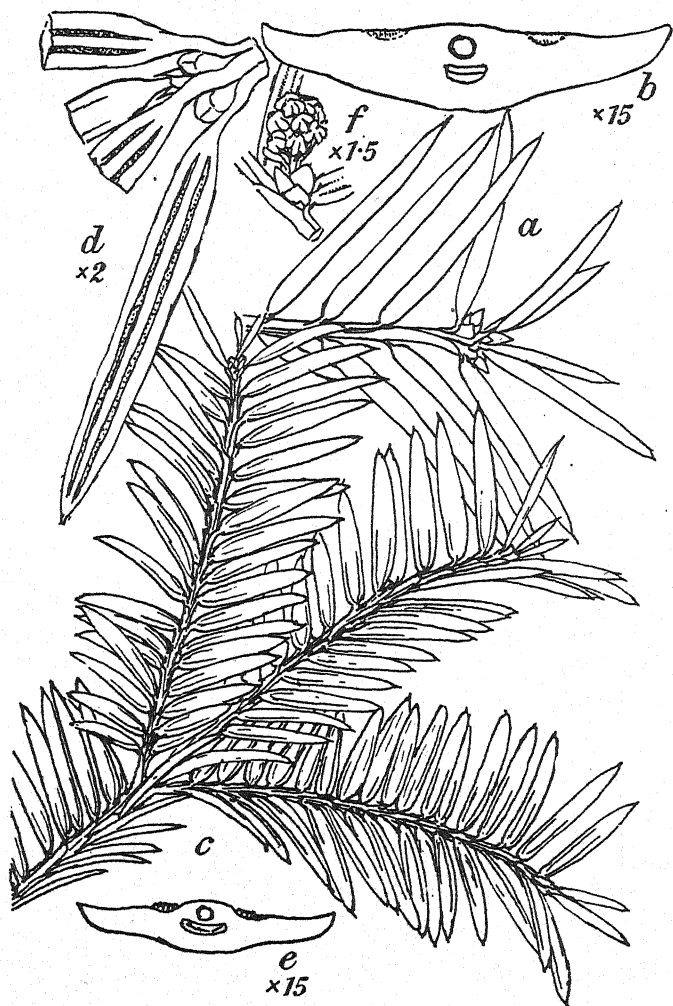


FIG. 2.—*TORREYA CALIFORNICA* and *T. GRANDIS*.
Torreya californica—a, shoot with leaf-buds; b, section of leaf. *T. grandis*—c, spray; d, under-surface of leaf and leaf-buds; e, section of leaf; f, male flower.

NOTE.—*Torreya grandis* Fortune (Fig. 2), a native of eastern China, is distinguished by its foliage not being aromatic when bruised and the shoots green in the second year, not brown as in the two species previously described. It was introduced into cultivation in 1855, but is rarely met with.

TAXUS Linnæus. YEW

Evergreen trees or shrubs with linear two-ranked leaves. Winter buds with obtuse scales. Flowers dicecious. Male flowers in stalked globular heads; anther scales peltate. Seed erect with a bony shell, borne in a scarlet fleshy cup or aril, ripening in the first year. Species one, with several geographical varieties sometimes regarded as separate species, widely distributed throughout the North temperate zone.

Taxus baccata Linnaeus. Common Yew.¹ Europe, N. Africa, W. Asia. (Fig. 3.)

A densely branched tree 30–60 ft. high, at length developing a massive trunk 20 ft. or more in girth. One of the three conifers indigenous to the British Isles and characteristic of chalk or limestone soils. The foliage and seeds are apt to be poisonous to cattle in this country.

Two of the most distinct of the many varieties of the common yew in cultivation are the var. *adpressa* Carrière with short leaves 6–12 mm. long and a broad shallow aril not covering the seed, and the Irish Yew, var. *fastigiata* Loudon, columnar and compact in habit, the branches and branchlets erect, which was discovered in the mountains of Fermanagh above Florence Court, Ireland, about the year 1780.

¹ For an account of remarkable yew trees in Great Britain, see Lowe, *Yew Trees of Great Britain and Ireland* (1897).



FIG. 3.—*TAXUS BACCATA* and *T. CUSPIDATA*.

Taxus baccata—a, spray with male flowers; b, male flower; c, spray with fruit; d, leaf-buds; e, under leaf-surface; f, section of leaf. *T. cuspidata*—g, spray; h, under-surface of leaf-tip.

Taxus cuspidata Siebold and Zuccarini, a native of Japan, Korea, and Manchuria, with dense dark green foliage and abruptly pointed leaves, is occasionally met with as a shrub in this country. (Fig. 3.)

PODOCARPUS Persoon

Leaves varying from linear to ovate, rarely scale-like, often with a two-ranked arrangement. Male flowers in catkins which are axillary, solitary or fascicled. Female flower solitary, consisting of one or two ovuliferous scales with several bracts at the base; these become thickened and often highly coloured at maturity forming a fleshy receptacle bearing the drupe or nut-like seed at the apex. About 60 species; chiefly in the tropical and sub-tropical regions of the Southern hemisphere.

See Orr, in *Transactions and Proceedings of the Royal Society of Edinburgh*, Vol. XXXIV, pt. 1 (1944), for a detailed account of the leaf anatomy of Podocarpus.

KEY TO PODOCARPUS

A. Leaves 5-10 cm. long	.	.	.	.	.	<i>P. salignus</i>
AA. Leaves 1-2 cm. long	.	.	.	.	.	<i>P. andinus</i>
AAA. Leaves 6-8 mm. long	.	.	.	.	.	<i>P. alpinus</i>

Podocarpus alpinus R. Brown. Victoria, New South Wales and Tasmania.

A dense shrub or small tree to 12 ft. or more. Introduced in 1860. In cultivation a small bush of rounded habit and of slow growth.

Podocarpus andinus Poeppig ex Endl. (Syn. *Prumnopitys elegans* Philippi.) Plum-fruited yew. Andes of S. Chile.

Tree up to 50 ft. high. Introduced in 1860 by Robert Pearce, collecting for Messrs. Veitch. In cultivation a

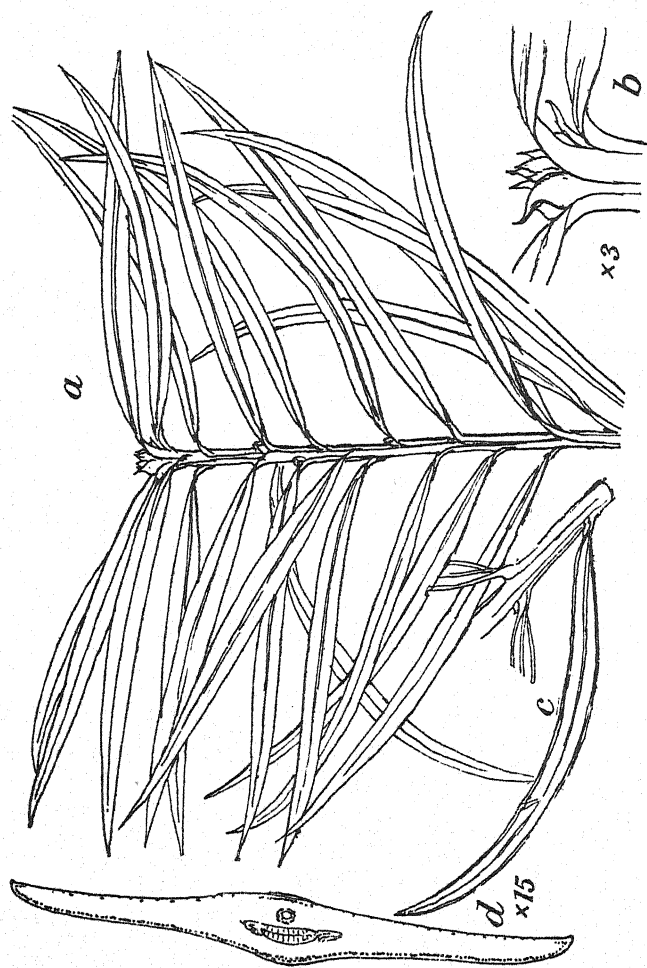


FIG. 4.—*PODOCARPUS SALIGNUS*.
a, shoot ; *b*, leaf-bud ; *c*, under-surface of leaf ; *d*, section of leaf.

small bushy tree of yew-like habit but with bluish-green foliage.

NOTEWORTHY SPECIMENS :

England. Devon : Woodhouse, Uplyme, 45 ft. Cornwall : Tregrehan, 30 ft. Wilts. : Stourhead, 29 ft.

Scotland. Argyll : Poltalloch, 33 ft.

Ireland. Co. Wicklow : Kilmacurragh, 41 ft. Co. Cork : Fota, 33 ft.

Podocarpus salignus D. Don. (Syn. *P. chilinus* Richard.)
Chile. (Fig. 4.)

Tree attaining 60 ft. in height. Introduced into cultivation in 1853. Hardy in the south of England, where it often grows into a handsome shrub or small tree.

NOTEWORTHY SPECIMENS :

England. Cornwall : Penjerrick, 40 ft., and specimens 30 ft. to 35 ft. at Tregrehan, Menabilly, Porthgidden, Trewidden and Trevince.

Ireland. Co. Down : Castlewellan, 38 ft. Co. Wicklow : Powers Court, 30 ft.

SAXEGOTHÆA Lindley

Foliage yew-like, leaves indistinctly two-ranked. Flowers monœcious, the male stalked in the axils of the leaves near the apex of the branchlets. Female flowers forming a small cone 8-12 mm. diameter at the end of the branchlets, shortly stalked, composed of spirally imbricated fleshy carpellary scales, each of the upper bearing two inverted ovules. Seeds 6-12. One species; Chile. (Fig. 5.)

Saxegothæa conspicua Lindley. Prince Albert's Yew.
Chile and W. Patagonia. (Fig. 5.)

Tree attaining 30-40 ft. in height. Introduced by

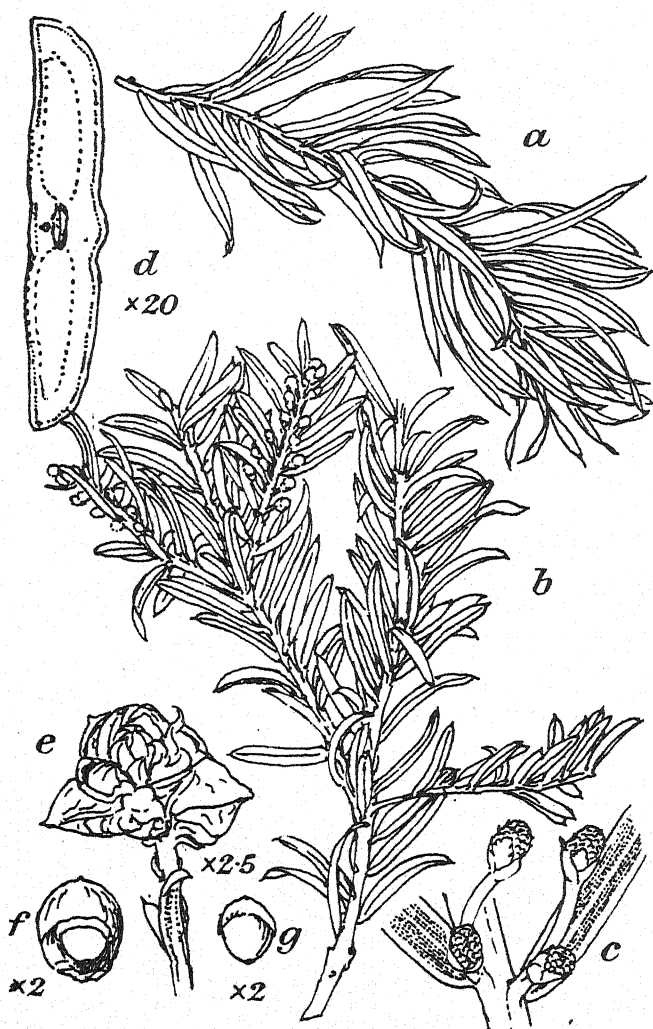


FIG. 5.—*SAXEGOTHÆA CONSPICUA*.

a, shoot; b, spray with two branchlets bearing young male flowers; c, under leaf-surface and four young stalked male flowers; d, section of leaf; e, fruiting cone; f, cone-scale with pendulous seed; g, seed with small aril.

Wm. Lobb in 1847 and named in honour of the Prince Consort.

NOTEWORTHY SPECIMENS :

England. Devon : Woodhouse, Uplyme, 41 ft. Cornwall : Tregrehan and Coldrinnick, 20 ft.

Ireland. Co. Down : Castlewellan, 20 ft.

PINACEÆ

ABIES Miller. FIR

Evergreen trees of pyramidal habit with branches more or less regularly whorled. Leaves persistent many years, needle-like, leaving a disc-like scar on the shoot, flattened, grooved and lustrous above with pale waxy bands of stomata beneath, rarely with stomata above, and traversed by 2, rarely 4 resin canals which are either marginal or median (Figs. 6 and 8). Cones ripening in one year, erect, ovoid-oblong or cylindrical, composed of numerous closely overlapping fan-shaped scales which fall when ripe from the persistent axis. Bracts either hidden between the scales or with exserted tips. Seeds winged, two to each scale. About 40 species, occurring chiefly in the temperate regions of the northern hemisphere.

NOTE.—The description of the leaves in the key and in the account of the following species refers to those of sterile lateral branches; the leaves of fertile branches and of leading shoots which are exposed to stronger light are as a rule shorter and thicker, usually acute, often spiny-pointed and more or less upturned or ascending: in some species the resin canals of the leaves of fruiting branches are internal, while those of the leaves of sterile branches are marginal.

The genus has been monographed by Vigué and Gaussen, "Revision du Genre *Abies*" (*Bull. Soc. Hist. Nat. Toulouse*, Vol. 58, fasc. 3, 1928-9).

KEY TO ABIES

- A. Leaves arranged more or less radially on the branchlets.
 - B. Branchlets glabrous, brownish. Leaves rigid, 1.5-2 cm. long, thick, obtuse at apex; resin canals median. *A. Pinsapo*
 - BB. Branchlets glabrous, shining, red-brown. Leaves flattened, about 1.5-2.8 cm. long, ending in a sharp point; resin canals marginal. *A. cephalonica*
- AA. Leaves on lower branchlets pectinate, or at least with a distinct parting above.
 - B. Resin canals marginal.
 - C. Buds 1 cm. or more long, spindle-shaped, with light-brown scales. Leaves 3-6 cm. long, rigid, ending in a spiny point; shoots glabrous. *A. venusta* (Syn. *A. bracteata*)
 - CC. Buds less than 1 cm. long. Leaves notched at apex.
 - D. Winter buds resinous.
 - E. Leaves green above, stomata on lower surface only.
 - F. Leaves on lower branchlets in one plane, up to 5 cm. long, those in the upper rank half the length of those below. Young shoots olive green, minutely pubescent. *A. grandis*
 - FF. Leaves all with a V-shaped arrangement. Branchlets more or less grooved.
 - G. Leaves rigid, greyish green beneath, often tipped with two horny points. Young shoots hairy in the grooves. *A. firma*
 - GG. Leaves white beneath.
 - H. Shoots slightly grooved, glabrous or somewhat hairy, reddish brown. Leaves typically up to 4 cm. long. *A. Delavayi*
 - HH. Shoots slightly grooved, glabrous, purplish brown. Leaves 2-3 cm. long. *A. Fargesii*
 - HHH. Shoots deeply grooved, hairy in the furrows, reddish brown. Leaves up to 6 cm. long. *A. spectabilis* (Syn. *A. Webbiana*)
 - EE. Leaves greyish green with stomata on both surfaces.
 - F. Leaves not adpressed to the shoot at the base, 5-6 cm. long.
 - G. Leaves on lower branchlets in one plane, rounded and slightly notched at apex. *A. Lowiana*
 - GG. Leaves lax in arrangement, imperfectly pectinate, some directed forward, entire at apex. *A. concolor*
 - FF. Leaves adpressed to the shoot at the base, 2.5-4 cm. long.
 - G. Leaves grooved above. *A. nobilis*
 - GG. Leaves quadrangular in section, not grooved above. *A. magnifica*

- DD. Winter buds not resinous. Shoots not grooved, pubescent. Leaves up to 3 cm. long, the upper ranks the shortest . . . *A. alba* (Syn. *A. pectinata*)
- BB. Resin canals median. Leaves 2-2.5 cm. long.
- C. Shoots smooth, not grooved, more or less pubescent.
- D. Shoots with straight hairs. Leaves grey beneath with 6-8 lines of stomata . . . *A. balsamea*
- DD. Shoots with dense curved reddish hairs. Leaves white beneath with 8-12 lines of stomata *A. Fraseri*
- CC. Shoots grooved, buff colour, glabrous. Winter buds resinous . . . *A. homolepis* (Syn. *A. brachyphylla*)
- AAA. Leaves overlapping above, not pectinate (except in some specimens of *A. cilicica*). Shoots more or less pubescent.
- B. Resin canals marginal.
- C. Winter buds non-resinous.
- D. Scales of winter buds with free prominent tips. Foliage lax . . . *A. cilicica*
- DD. Scales of winter buds with adpressed tips. Foliage dense . . . *A. Nordmanniana*
- CC. Winter buds resinous.
- D. Shoots with pale brown hairs, smelling like orange-peel when cut. Leaves arranged as in *A. Nordmanniana* 2-3 cm. long with a truncate, notched apex . . . *A. amabilis*
- DD. Shoots with reddish-brown hairs. Leaves up to 2 cm. long . . . *A. Mariesii*
- BB. Resin canals median. Winter buds resinous.
- C. Shoots not grooved, densely pubescent with dark brown hairs. Leaves up to 3 cm. long, with two broad white bands of stomata beneath in 9-10 lines . . . *A. Veitchii*
- CC. Shoots slightly grooved, hairy in the grooves. Leaves up to 4-5 cm. long, stomata in 7-8 lines . . . *A. sachalinensis*
- CCC. Shoots minutely hairy. Leaves up to 3 cm. long, stomata in 4-5 lines . . . *A. sibirica*
- AAAA. Leaves directed more or less forwards or upwards above, loosely adpressed beneath.
- B. Winter buds resinous.
- C. Young shoots glabrous, grey. Leaves bright green, up to about 6 cm. long, acute or bifid at the tip; resin canals median . . . *A. Pindrow*
- CC. Young shoots ashy grey, with short reddish hairs. Leaves glaucous green with stomata on both surfaces 3-3.5 cm. long; resin canals median . . . *A. lasiocarpa*
- CCC. Young shoots grey to purplish, sparsely hairy. Leaves dark green, with two broad white bands of stomata beneath 1-2 cm. long; resin canals marginal *A. koreana*
- BB. Winter buds not resinous.
- C. Young shoots glabrous and shining. Leaves crowded on the upper side of the shoot often pointing backwards, 2 cm. long, with stomata on the upper surface near the tip . . . *A. numidica*

Abies alba Miller. (Syn. *A. pectinata* De Candolle.) European Silver Fir. Mountains of Central and S. Europe. (Fig. 6.)

A tree attaining a height of 150 ft. and a girth of 20 ft. Introduced about 1608. An important forest tree in Europe. Less frequently planted in England than formerly owing to its susceptibility to the attacks of fungi and insect pests. In the British Isles it attains a greater height than most other conifers.

NOTEWORTHY SPECIMENS :

England. Surrey : Bury Hill, Dorking, 184 ft. \times 13 ft.

Other specimens of 120 ft. or over are at Cowdray Park, and Sheffield Park, Sussex ; Embley Park, Exbury and Highclere, Hants., Penjerrick, Cornwall.

Scotland. Argyll : Inveraray, 168 ft. \times 20 ft. 7 in. This is believed to be one of the tallest trees in the British Isles, the other being a Douglas Fir at Powis Castle, Montgomery.

Abies amabilis Forbes. British Columbia, Oregon and Washington. (Fig. 7.)

Tree attaining 250 ft. with a girth of 18 ft. Introduced in 1830, but rarely growing to a large size in England. It is subject to "knotty disease" due to the attacks of a species of *Chermes* which causes gouty swellings of the branches.

NOTEWORTHY SPECIMENS :

England. Cornwall : Pencarrow, 53 ft. \times 9 ft.

Scotland. Perth : Murthly, 60 ft. \times 5 ft.

Ireland. Co. Down : Castlewellan, 52 ft. \times 4 ft.

Abies balsamea Miller. Balm of Gilead. Canada, N. United States to Alleghany Mountains and S.W. Virginia.

A tree attaining 60 ft. or occasionally 75 ft. in height

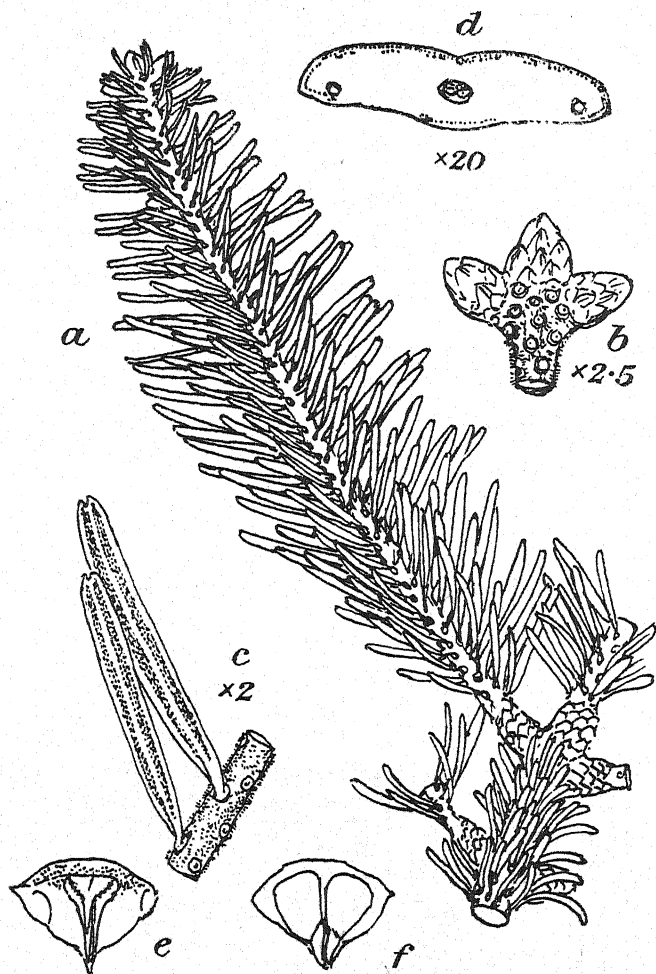


FIG. 6.—*ABIES ALBA*.

a, upper side of spray; *b*, non-resinous winter-buds; *c*, under-surface of leaves and shoot; *d*, section of leaf, showing marginal resin canals; *e*, cone-scale with bract recurved at the tip; *f*, seed.

and 3 to 5 ft. in girth. Introduced before 1700. It is a short-lived tree in this country and has no value for ornamental purposes. Canada balsam is obtained from the bark blisters.

NOTEWORTHY SPECIMENS :

Scotland. Angus : Craigo, 20 ft.

Ireland. Co. Leix (Queens Co.) : Blandsfort, 29 ft.

Co. Carlow : Fenagh House, 19 ft.

Abies cephalonica Loudon. Greek Fir. Mountains of Greece up to 5,700 ft. altitude.

A tree attaining 100 ft. in height and 15 ft. in girth. Frequently grown as an ornamental tree in this country. Introduced in 1824 by General Sir Charles Napier.

NOTEWORTHY SPECIMENS :

England and Wales. Hants. : Highclere, 101 ft. \times 13 ft.

Trees between 90 ft. and 100 ft. in Surrey : Bury Hill.

Bedford : Woburn Abbey. Yorks. : Studley Royal.

Denbigh : Bodnant, 104 ft. Others between 80 ft.

and 90 ft. in Northumberland : Falloden. Wilts. :

Wilton Park. Glos. : Westonbirt.

Abies cilicica Carrière. Asia Minor, Syria.

Tree attaining 100 ft. in height and 7 ft. in girth. Introduced in 1850, but trees above 50 ft. high are rarely seen.

NOTEWORTHY SPECIMENS :

England. Berks : Welford Park, 69 ft. \times 7 ft. Norfolk : Holkham, 65 ft. \times 5 ft.

Scotland. Wigtown : Castle Kennedy, 68 ft. \times 6 ft.

Abies concolor Lindley and Gordon. Colorado, Arizona, New Mexico.

Tree attaining 100-150 ft. in height and 12 ft. in girth. Introduced about 1873. A handsome conifer when well

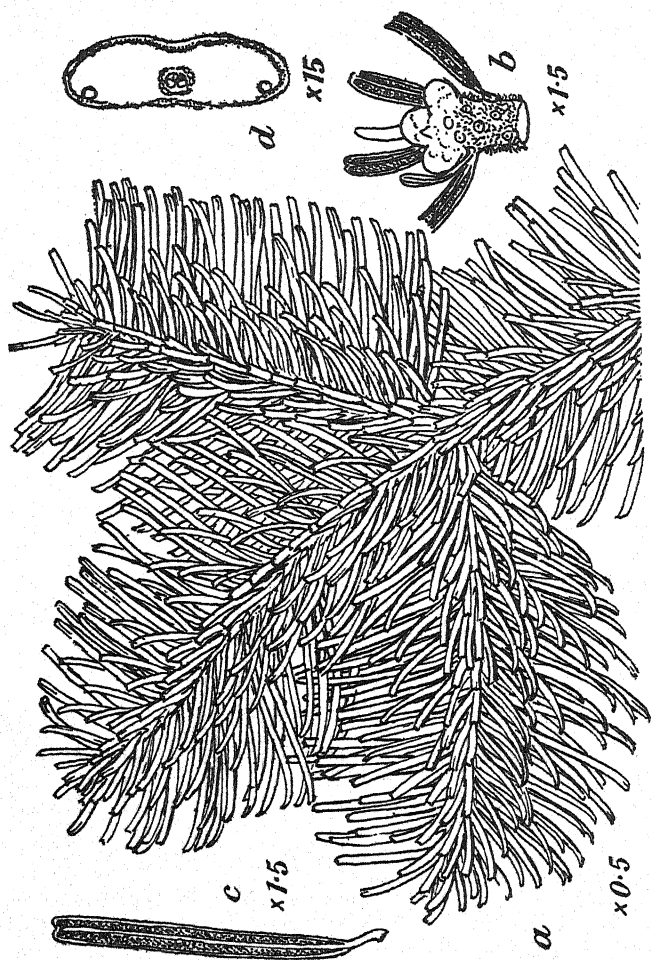


FIG. 7.—*ABIES AMABILIS*.

a, spray, upper surface; b, resinous, winter buds; c, leaf, under-surface; d, leaf in section, showing marginal resin canals.

grown, especially when young and in its more glaucous forms.

NOTEWORTHY SPECIMENS :

England. Devon : Bicton, 114 ft. \times 11 ft. Sussex :
Warnham Court, 85 ft. \times 8 ft. 6 in. Yorks :
Studley Royal, 80 ft. \times 7 ft.

Scotland. Kincardine : Durris, 107 ft. \times 12 ft. Perth :
Castle Menzies, 105 ft. \times 9 ft. Blair Atholl,
104 ft. \times 9 ft. 6 in. Argyll : Ben More, 104 ft. \times
8 ft.

Abies Delavayi Franchet. (Syn. *A. Fabri* Craib.)
Chinese Silver Fir. W. China and Upper Burma.

Tree attaining a height of 60-100 ft. Introduced about
1910.

The var. *Forrestii* A. B. Jackson (*A. Forrestii* Craib)
as seen in cultivation has the young shoots which are
either glabrous or hairy, bright rusty red. The silver fir
introduced from Western China as *A. Faxoniana* Rehder
& Wilson appears to be a form of *A. Delavayi* with foliage
less white beneath and shoots often densely pubescent.
Unfortunately the species does not seem likely to be
long-lived in this country judging from the unhealthy
condition of the earlier planted specimens, most of which
now seem to be failing. By some authorities the name
A. Delavayi is restricted to a plant with the leaves strongly
revolute at the margin. This form does not appear to be
in cultivation.

The Silver Firs in this group are extremely variable,
and after a careful study of the many forms now to be
met with in gardens we are unable to find any constant
combination of shoot, leaf and cone characters which can
be used for diagnostic purposes. The trees met with in
collections here do not appear to us to represent more
than a single variable species.

NOTEWORTHY SPECIMENS :

England. Sussex : Borde Hill, 18 ft. and 14 ft. ; Wakehurst, 18 ft.

Ireland. Co. Meath : Headfort, 23 ft., 20 ft. and 15 ft. 6 in. Co. Wicklow : Kilmacurragh, 10 ft. 6 in.

Abies Fargesii Franchet. Western China.

Tree about 100 ft. high. Introduced since 1910. Young trees of this fir have been cultivated for some years under the name of *A. sutchuenensis*, which is now considered conspecific with *A. Fargesii*. It can generally be recognized without difficulty by its glabrous, purplish-brown shoots.

NOTEWORTHY SPECIMENS :

England. Hants. : Hillier's Nursery, Winchester, 10 ft.

Ireland. Co. Meath : Headfort, 14 ft. and 11 ft. 6 in.

Scotland. Peebles : Dawyck, 27 ft.

Abies firma Siebold and Zuccarini. S. Japan from sea level to 7,000 ft.

A tree attaining 150 ft. in height and 16 ft. in girth. Introduced in 1861 by J. G. Veitch, and not very common in cultivation. Although quite hardy, it seems to require a mild moist climate to bring it to perfection.

NOTEWORTHY SPECIMENS :

England. Cornwall : Carclew, 82 ft. \times 7 ft. ; Pen-carrow, 60 ft. \times 9 ft. *Glos.* : Tortworth Court, 75 ft. \times 7 ft. 6 in. ; Westonbirt, 69 ft. \times 5 ft. 5 in. *Devon* : Bicton, 71 ft. \times 7 ft. *Beds.* : Woburn, 60 ft. \times 5 ft.

Abies Fraseri Poiret. Alleghany Mountains, W. Virginia to N. Carolina and Tennessee.

Tree attaining 40-70 ft. First cultivated in England

in 1811. It does not succeed well in the British Isles, only small trees being recorded.

NOTEWORTHY SPECIMENS :

England. Sussex : Tilgate, 28 ft.

Scotland. Perth : Dupplin Castle, 42 ft. (1939).

Abies Gamblei Hickel. (*A. Pindrow* var. *brevifolia* Dallimore and Jackson.) W. Himalaya.

This fir is closely allied to *A. Pindrow*, differing chiefly in its shorter leaves. It is apparently not very hardy.

NOTEWORTHY SPECIMENS :

England. Sussex : Borde Hill, 46 ft. \times 3 ft. Hertfordshire : Bayfordbury, 20 ft.

Scotland. Peebles : Dawyck, 43 ft. \times 3 ft. 2 in.

Ireland. Co. Wicklow : Kilmacurragh, 45 ft. \times 4 ft.

Abies grandis Lindley. Giant Fir. Western N. America from Vancouver Island to California from sea-level to 3,500 ft.

A tree attaining a height of 300 ft. and a girth of 16 ft. Introduced by Douglas about 1832. It is frequently grown as an ornamental tree and is one of the fastest growing firs in the British Isles and also one of the tallest ; it is intolerant of shade.

NOTEWORTHY SPECIMENS :

England and Wales. Berks. : Welford Park, 120 ft. \times 10 ft. 9 in. Devon : Bicton, 119 ft. \times 12 ft. Denbigh : Bodnant, 127 ft. \times 11 ft. (1944). Glos. : Westonbirt, 127 ft. \times 9 ft. 4 in. (1940).

Scotland. Perth : Murthly Castle, 124 ft. 6 in. Angus : Glamis Castle, 119 ft. \times 12 ft. Kincardine : Durris, 116 ft. \times 11 ft.

Abies homolepis Siebold and Zuccarini. (*A. brachyphylla* Maximowicz.) Mountains of Central Japan at 2,500-5,000 ft. (Fig. 8.)

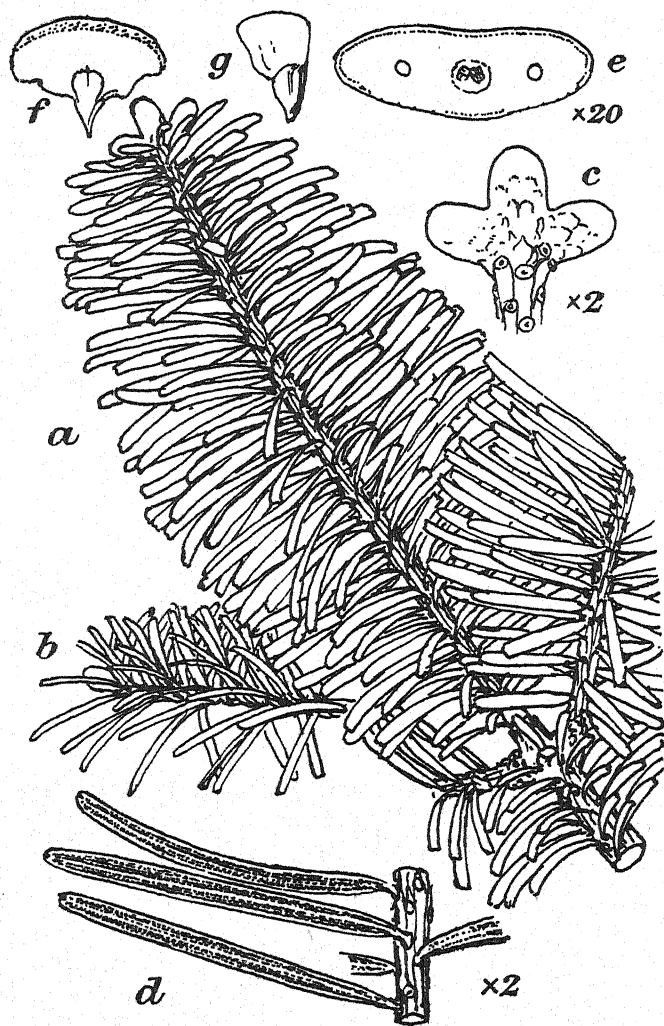


FIG. 8.—*ABIES HOMOLEPIS*.

a, spray, upper surface; *b*, end of branchlet seen in profile; *c*, resinous winter buds; *d*, under-surface of leaf, showing stomatal bands; *e*, leaf in section, showing median resin canals; *f*, cone-scale, consisting of a bract and seed-bearing scale; *g*, seed.

A tree 80-90 ft. high with a girth up to 16 ft. Introduced by J. G. Veitch in 1861. It thrives in most parts of the British Isles and is probably the most successful of the Japanese firs in this country.

NOTEWORTHY SPECIMENS :

England and Wales. Gos. : Westonbirt, 67 ft. 6 in.
Denbigh : Bodnant, 83 ft. (1944). Sussex : Borde Hill, 57 ft. ; Warnham Court, 58 ft. \times 6 ft.

Abies koreana Wilson. Korea.

Tree attaining 30-50 ft. with a trunk 3-6 ft. in girth. Introduced in 1908. Young trees are distinguished by their smooth silvery grey or purplish shoots and bright green foliage. The species thrives almost everywhere in England, producing its small purple cones freely when only a few feet high.

NOTEWORTHY SPECIMEN :

England. Sussex : Borde Hill, 20 ft.

Abies lasiocarpa Nuttall. (*A. subalpina* Engelm.)
Rocky Mountain Fir. Alaska, Oregon, Utah and North Mexico.

Tree attaining 60-130 ft. in height and 9-12 ft. in girth. Introduced in 1863. An alpine species which has made but little headway in cultivation.

NOTEWORTHY SPECIMENS :

England. Sussex : Bore Hill, 15 ft.
Scotland. Peebles : Dawyck, 30 ft.

Abies Lowiana Murray. (Syn. *A. concolor* var. *Lowiana* Lemmon.) Mountains of Oregon and California.

Tree attaining 250 ft. in height and 18 ft. in girth. Introduced in 1851 by Wm. Lobb. It is regarded by American botanists as a variety of *A. concolor*, but in cultivation the arrangement of the foliage is markedly

different. In this country it is a handsome tree frequently met with in collections.

NOTEWORTHY SPECIMENS :

England and Wales. Kent : Linton Park, 113 ft. \times 14 ft.
Lincoln : Brocklesby Park, 101 ft. \times 9 ft. Devon :
Woodhouse, Uplyme, 102 ft. \times 8 ft. Denbigh :
Bodnant, 103 ft. (1944). Glos. : Westonbirt, 110 ft.
 \times 11 ft. (1945).

Scotland. Perth : Murthly Castle, 129 ft. \times 14 ft.
Kincardine : Durris, 107 ft. \times 12 ft.

Abies magnifica A. Murray. Red Fir. Mountains of
Oregon and California.

Tree attaining 200 ft. in height and a girth of 12-25 ft.
Introduced in 1851 by John Jeffrey. A handsome conifer
of regular habit. In the British Isles it thrives best in
Scotland.

NOTEWORTHY SPECIMENS :

England and Wales. Devon : Woodhouse, Uplyme,
90 ft. \times 8 ft. Somerset : Mells, about 80 ft.
Norfolk : Holkham, 80 ft. \times 4 ft. 9 in. Radnor :
Silia, 93 ft. \times 8 ft. 2 in.

Scotland. Lanark : Dolphinton, 98 ft. \times 7 ft. Angus :
Glamis Castle, 98 ft. \times 8 ft. 7 in. ; Taymouth
Castle, 73 ft. \times 7 ft. 9 in.

Abies Mariesii Masters. Mountains of Central Japan.

Tree attaining 80 ft. in height and 6 ft. in girth. Intro-
duced in 1879. Rarer in cultivation than *A. Veitchii*,
which it resembles in its leaf arrangement, but the young
shoots are clothed with reddish-brown pubescence and the
leaves are shorter.

NOTEWORTHY SPECIMENS :

England. Cornwall : Tregrehan, 50 ft. \times 3 ft. 6 in.
(1939). Hereford : Hergest Croft, 27 ft.

Scotland. Ross.: Brahan Castle, 30 ft. Peebles.: Dawyck, 32 ft.

Ireland. Co. Down: Castlewellan, 44 ft. \times 5 ft.

Abies nobilis Lindley. Washington, S. to N. California.
(Fig. 9.)

Tree attaining 250 ft. in height with a maximum girth of 24 ft. Discovered by David Douglas in 1825 and introduced by him in 1830. It has been extensively and successfully planted as an ornamental tree throughout the British Isles.

NOTEWORTHY SPECIMENS:

England. Sussex: Cowdray Park, 114 ft. \times 8 ft.

Scotland. Perth: Murthly, 136 ft. \times 10 ft. 2 in.

Argyll: Stonefield, 135 ft. \times 11 ft. 7 in. Angus:

Kirriemuir, 112 ft. \times 11 ft. 5 in. Kirkcudbright:

Munches, 117 ft. \times 9 ft. 3 in. Kincardine: Durris,

112 ft. \times 11 ft. 6 in.

Abies Nordmanniana Spach. Caucasian Fir. Caucasus, Asia Minor.

Tree attaining 200 ft. in height and 15 ft. in girth. Introduced in 1848. Commonly cultivated in the British Isles. It has no value for forestry purposes in this country.

NOTEWORTHY SPECIMENS:

England. Devon: Woodhouse, Uplyme, 108 ft. \times 7 ft.

Surrey: Albury Park, 92 ft. \times 5 ft. Sussex:

Leonardslee, 102 ft. \times 9 ft. Shropshire: Leaton

Knolls, 96 ft. \times 5 ft. Devon: Endsleigh, 100 ft.

\times 10 ft.

Scotland. Peebles: Dawyck, 100 ft. \times 9 ft. 8 in.

Abies numidica De Lannoy. Algerian Fir. N. Africa.

Tree attaining 70 ft. in height and 8 ft. in girth. Introduced in 1862. A handsome fir which, though quite hardy, is uncommon in cultivation.

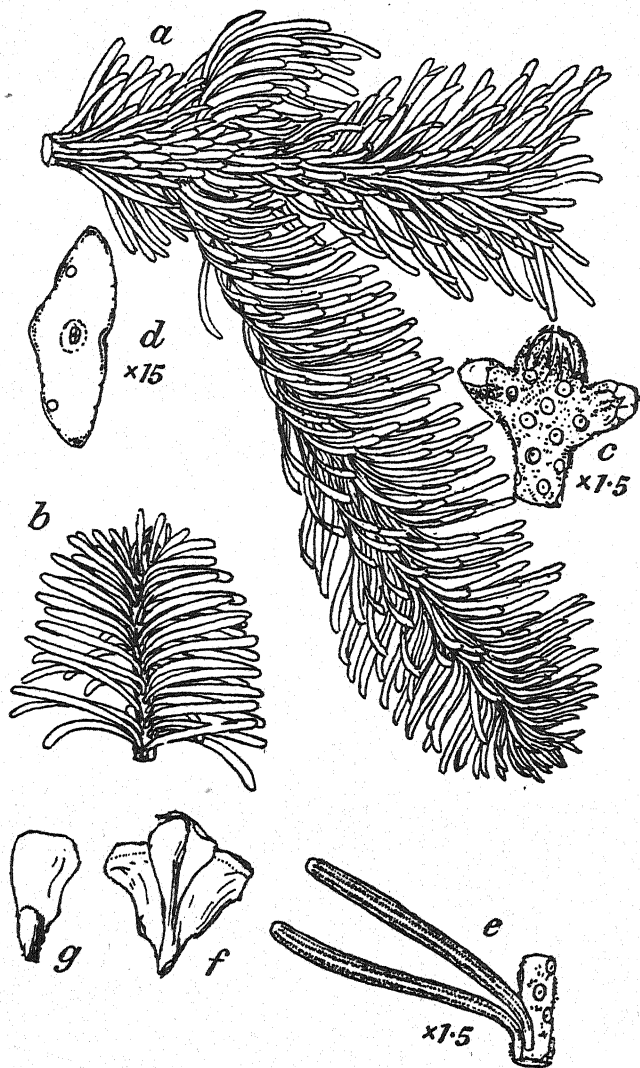


FIG. 9.—*ABIES NOBILIS*.

a, spray from above; *b*, from beneath; *c*, resinous winter buds; *d*, leaf in section, showing marginal resin canals; *e*, under-surface of leaves and shoot; *f*, cone scale with long bract; *g*, seed.

NOTEWORTHY SPECIMENS :

England. Devon : Bicton, 95 ft. \times 8 ft. Glos. : Westonbirt, 63 ft. \times 5 ft. 6 in.

Abies Pindrow Spach. Western Himalayas from Afghanistan to Nepal at 7,000–12,000 ft. altitude.

Tree attaining 200 ft. in height with a girth of 26 ft. Introduced in 1837. It grows best in the milder and moister parts of the British Isles.

NOTEWORTHY SPECIMENS :

England. Worcester : Hewell Grange, 78 ft. \times 6 ft. 4 in.
Oxford : The Coppice, Henley, 78 ft. \times 4 ft. 10 in.
Hereford : Broxwood Court, 76 ft. \times 4 ft. 9 in.
Cornwall : Scorrier House, 75 ft. \times 8 ft. 5 in.
Surrey : Bury Hill, Dorking, 72 ft. \times 4 ft. 4 in.

Ireland. Co. Cavan : Farnham, 100 ft. \times 11 ft.

Abies Pinsapo Boissier. Spanish Fir. Mountains of S. Spain around Ronda. (Fig. 10.)

A tree attaining 100 ft. in height and 15 ft. in girth. Introduced in 1839 by Captain Widdrington. This is one of the easiest firs to identify on account of its short, stiff, spreading foliage ; it thrives in the British Isles even on chalky soils, but good specimens are uncommon.

NOTEWORTHY SPECIMENS :

England and Wales. Glos. : Westonbirt, 82 ft. \times 7 ft.
Hants. : Rhinefield, 80 ft. 5 in. Cambridge : Pampisford, 79 ft. \times 7 ft. 6 in. Sussex : Lydhurst, 60 ft. \times 11 ft. Denbigh : Bodnant, 86 ft.

Ireland. Co. Limerick : Adare House, 87 ft. \times 11 ft. 9 in. Co. Waterford : Curraghmore, 85 ft. \times 10 ft.

Abies sachalinensis Masters. Japan. Saghalien.

Tree attaining 130 ft. in height and a maximum girth of 9 ft. Introduced by Maries in 1879. It has made little

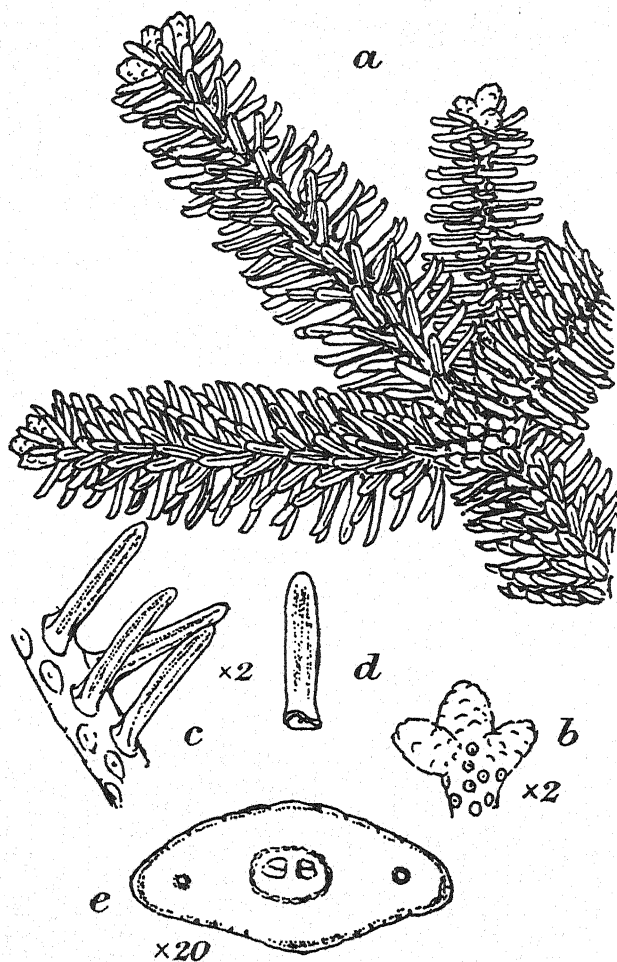


FIG. 10.—*ABIES PINSAPO*.

a, spray; *b*, resinous winter buds; *c*, leaves and shoot; *d*, anterior face of leaf; *e*, section of leaf showing median resin canals.

headway in cultivation, its growth being generally checked by spring frosts.

NOTEWORTHY SPECIMENS :

England and Wales. Kent: Little Hall, 35 ft. Glamorgan: Duffryn, 55 ft. \times 2 ft. 9 in.

Scotland. Ross: Ardross Castle, 36 ft. Peebles: Dawyck, 24 ft.

Abies sibirica Ledebour. N. and E. Russia and Siberia, where it forms vast forests.

Tree attaining 100 ft. high with a slender trunk. Introduced into cultivation in 1820. Few trees are met with in this country and it is apt to suffer from spring frosts

NOTEWORTHY SPECIMENS :

Ireland. Co. Carlow: Fenagh House, 12 ft. Co. Meath: Headfort, 15 ft.

Scotland. Peebles: Dawyck, 14 ft. 9 in.

Abies spectabilis Spach. (*A. Webbiana* Lindley.) Himalaya from Afghanistan to Bhutan at 8,000–13,000 ft.

Tree attaining 150–200 ft. high and a girth of 20–30 ft. Introduced early in the nineteenth century. It only succeeds in the milder parts of the British Isles, good specimens being met with in the west of England. The bluish-purple cones with concealed bracts become dark brown when mature.

The var. *brevifolia* Rehder (*A. brevifolia* Henry) has shorter leaves with greyish stomatic bands beneath.

NOTEWORTHY SPECIMENS :

England. Devon: Woodhouse, Uplyme, 95 ft. \times 8 ft. (var. *brevifolia*). Sussex: Beauport, 80 ft. \times 10 ft. Cornwall: Tregothnan, 74 ft. 6 in.

Scotland. Argyll: Stonefield, 88 ft. 6 in. \times 8 ft. 7 in. Perth: Taymouth Castle, 75 ft.

Abies Veitchii Lindley. Mountains of Central Japan.

A fir 60-70 ft. high with a slender trunk. Introduced in 1879 by Maries. It thrives in the British Isles and is very handsome in a young state with its glossy green foliage, intensely white beneath. The cones are plum-coloured before maturity, becoming brown when ripe.

NOTEWORTHY SPECIMENS :

England. Sussex : Nymans, 81 ft. 3 in. Wilts. :

Bowood, 62 ft. Cornwall : Tregrehan, 60 ft.

Scotland. Moray : Darnaway, 63 ft.

Ireland. Co. Wicklow : Powerscourt, 78 ft. Co. Kerry : Derreen, 65 ft.

Abies venusta Koch. (Syn. *A. bracteata* Nuttall.) Bristle-cone Fir. Native of Santa Lucia Mountains, California.

A tree attaining 100-150 ft. high and 9 ft. in girth. Introduced by Lobb in 1853. When well grown it is one of the handsomest firs in cultivation, but good specimens are rare in this country. Its English name refers to the long bristle-like tips to the bracts which protrude far beyond the cone scales.

NOTEWORTHY SPECIMENS :

England and Wales. Hereford : Eastnor Castle, 112 ft.

× 12 ft. 9 in. Denbigh : Bodnant, 103 ft. Glos. :

Tortworth, 80 ft. × 9 ft. 6 in. Somerset : Mells

Park, 75 ft. × 8 ft. Northampton : Althorp, 74 ft.

Sussex : Warnham Court, 67 ft. Devon : New Court, 66 ft.

NOTE :

Abies squamata Masters

A Chinese species occurring at high altitudes in W. Szechuan, with shaggy purplish brown bark, exfoliating in thin papery layers like that of a birch. Young plants occasionally met with in cultivation have bright red shoots, resinous buds, with stiff widely-spreading, sharply-pointed leaves. There is a tree 20 ft. high at Ben More, Argyll.

KETELEERIA Carrière

Evergreen trees with horizontally spreading branches. Winter buds ovoid or globose, not resinous. Leaves linear, keeled on both sides, spine-tipped on young plants, obtuse on adult trees. Flowers monœcious. Male flowers in terminal or axillary umbels or clusters bearing numerous anthers, each with two pollen sacs. Cones erect, ovoid to cylindric-oblong with broad, woody, persistent scales ripening in the first year. Seeds two, with wings nearly equalling the scale. Two species in China.

Keteleeria Davidiana Beissner. China.

A tree up to 100 ft. in height. Introduced in 1888 by Henry. Occasionally met with as a shrub or small tree in this country. It resembles a silver fir in habit; eventually assumes an irregular form with massive branches.

NOTEWORTHY SPECIMENS :

- England.* Surrey: Kew Gardens, 17 ft. Sussex:
Leonardslee, 16 ft.
Ireland. Co. Meath: Headfort, 14 ft.

PICEA A. Dietrich. **SPRUCE.**

Evergreen trees of pyramidal habit with whorled branches. Leaves needle-like or linear, angular or flattened, leaving projecting peg-like bases on the shoot when they fall. Flowers monœcious. Male catkins ovoid or cylindrical, yellow or crimson in colour, composed of numerous spirally arranged stamens. Cones pendulous with persistent scales, ripening during the first autumn. About 40 species, widely distributed in the temperate and north temperate regions of the northern hemisphere.

KEY TO PICEA

- A. Leaves flattened; stomatic bands mostly on one surface only.
 - B. Young shoots glabrous.
 - C. Leaves pectinate on lower surface of branchlet, exposing the shoot.
 - D. Cone scales flexible with toothed margins.
 - E. Leaves pungent. Lateral leaves spreading outwards *P. sitchensis*
 - EE. Leaves pointed but not pungent *P. jezoensis*
 - DD. Cone scales rigid with margins entire or toothed. Leaves pungent, the lateral ones directed somewhat forward *P. brachytyla*
 - CC. Leaves somewhat radially arranged, ending in a sharp point. Cone scales entire *P. spinulosa* (Syn. *P. morinoides*)
 - BB. Young shoots hairy.
 - C. Branchlets pendulous. Foliage lax. Leaves 25-30 mm. long *P. Breweriana*
 - CC. Branchlets usually spreading and ascending. Foliage rather dense. Leaves 12-18 mm. long *P. Omorika*
- AA. Leaves quadrangular or rhombic in section; stomatic lines on all four sides.
 - B. Leaves radially arranged, spreading all round the shoot. Shoots usually glabrous.
 - C. Branchlets pendulous, greyish. Buds fusiform, 12 mm. long, not resinous. Foliage lax. Cones up to 18 cm. long *P. Smithiana* (Syn. *P. Morinda*)
 - CC. Branchlets not pendulous, yellowish or reddish-brown. Buds ovoid, resinous, 5 mm. long. Cones up to 6 cm. long *P. Maximowiczii*
 - BB. Leaves imperfectly pectinate beneath.
 - C. Leaves 12-20 mm. long, pungent.
 - D. Shoots reddish or yellowish brown, winter buds conical *P. asperata*
 - DD. Shoots becoming reddish brown. Winter buds ovoid, the upper scales sometimes slightly reflexed at the tips *P. pungens*
 - DDD. Shoots stout, yellowish brown. Winter buds ovoid, shining, reddish brown. Leaves stout, rigid, curved *P. polita*
 - CC. Leaves up to 35 mm. long, not pungent. Shoots greyish. Terminal bud dome-shaped with keeled pubescent scales *P. Schrenkiana*
 - BBB. Leaves imbricated on upper sides of the shoot, pectinate below.
 - C. Shoots glabrous or slightly hairy.
 - D. Leaves with stomatic bands on two sides, often broader than those on the other two.
 - E. Shoots reddish brown, usually glabrous *P. bicolor*
 - EE. Shoots pale brown, sparsely hairy¹ *P. likiangensis*

¹ The shoots are densely hairy in var. *purpurea*.

- DD. Leaves with stomatic bands fairly equally distributed on all sides.
- E. Shoots greyish, pale brown or whitish.
- F. Shoots glaucous or pale brown. Leaves 12 mm. long, with a rank smell when bruised. *P. glauca* (Syn. *P. alba*)
- FF. Shoots pearly grey or whitish. Leaves slightly curved, with no distinct smell
P. Wilsonii
- EE. Shoots reddish brown.
- F. Shoots slightly glaucous; leading shoots glabrous, lateral shoots with scattered glandular hairs in the furrows. Leaves 8-12 mm. long, acute or obtuse *P. Koyamai*
- FF. Shoots not glaucous, glabrous or slightly hairy all over. Leaves 12-25 mm. long ending in a blunt horny point
P. Abies (Syn. *P. excelsa*)
- CC. Shoots conspicuously hairy.
- D. Terminal bud surrounded at the base by long awl-shaped scales.
- E. Shoots with short often glandular hairs. Leaves densely arranged; dull or glaucous green, acute, 10-15 mm. long. Cones 25 mm. long
P. mariana (Syn. *P. nigra*)
- EE. Shoots as in *P. nigra*. Leaves shining green, acute, 10-15 mm. long, curved, cones 40-50 mm. long *P. rubens* (Syn. *P. rubra*)
- EEE. Shoots reddish, hairy in the furrows, hairs short, non-glandular. Leaves slender, 6-12 mm. long
P. Glehni
- DD. Terminal buds with basal scales acute or with short subulate tips.
- E. Young shoots greyish covered with dense non-glandular hairs. Leaves dark shining green, 6-12 mm. long, obtuse. Cones 6-8 cm. long, with rounded entire scales *P. orientalis*
- EE. Young shoots greyish yellow with minute glandular hairs. Leaves glaucous green, 21-25 mm. long, acute, rank smelling when bruised. Cones 4-7 cm. long, with thin wavy, toothed scales
P. Engelmanni

Picea Abies Karsten. (*P. excelsa* Link.) Common Spruce.

N. and Central Europe. (Fig. 11.)

Tree attaining 200 ft. in height and 15-20 ft. in girth. Known in cultivation in this country since 1548 and one of the commonest and hardiest conifers. Many cultivated varieties have been described. The timber is largely

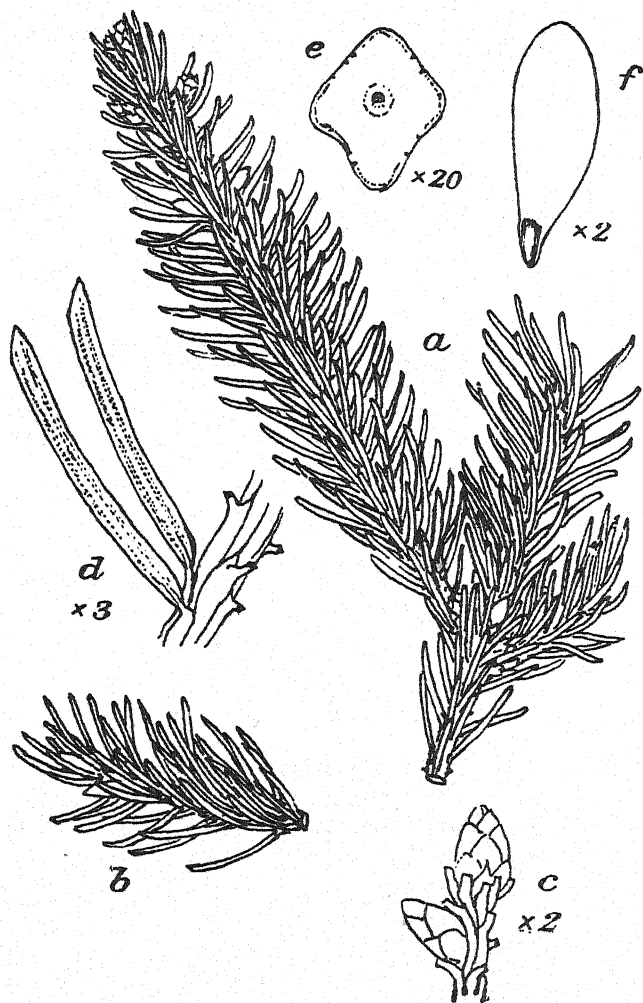


FIG. 11.—*PICEA ABIES*.
a, spray from above, *b*, from side; *c*, winter buds; *d*, under-surface
 of shoot and leaves; *e*, section of leaf; *f*, seed.

imported from Norway and Russia; this species and *Abies alba* are both known in the trade as white deal.

NOTEWORTHY SPECIMENS :

England. Yorks. : Studley Royal, 150 ft. \times 14 ft.

Scotland. Argyll: Inveraray, 135 ft. Perth: Dupplin,
130 ft. \times 11 ft. 6 in. Dumfries: Langholm,
129 ft. \times 12 ft. 1 in.

Picea asperata Masters. Western China.

Tree up to 100 ft. high. Introduced in 1910 by Wilson. The common quadrangular-leaved spruce of western Szechuan closely resembling *P. Abies* in appearance. The spruces from western China described under the names of *P. aurantiaca* Masters, *P. Neoveitchii* Masters, *P. gemmata* Rehder and Wilson, *P. heterolepis* Rehder and Wilson appear to be variants of *P. asperata*, which is the hardiest of the Chinese spruces in this country. In Scotland at Dawyck there is a thriving two-acre plantation of this spruce growing at 900 ft. elevation. The trees have borne fertile seeds for some years.

NOTEWORTHY SPECIMENS :

England. Hereford: Hergest Croft, 22 ft. 9 in. Kent :
Vernon Holme, 21 ft.

Scotland. Wigtown: Logan, 20 ft.

Ireland. Co. Dublin: Glasnevin, 20 ft.

Picea bicolor Mayr. Alcock's Spruce. Mountains of Central Japan.

Tree to 80 ft. in height. Introduced in 1861, but not often met with except in Conifer collections.

NOTEWORTHY SPECIMENS :

England. Devon: Bicton, 67 ft.

Scotland. Lanark: Dolphinton, 82 ft. \times 6 ft. 11 in.
Wigtown: Castle Kennedy, 66 ft.

Picea brachytyla Pritzel. (Syn. *P. complanata* Masters, *P. ascendens* Patschke, *P. Sargentiana* Rehder and Wilson.) Mountains of Central China.

Tree 35-80 ft. in height. Introduced in 1901. It has been ruthlessly cut for timber in its native country and is now much rarer than formerly. In the British Isles it succeeds best in the southern and western counties.

NOTEWORTHY SPECIMENS :

England. Surrey : Leonardslee, 35 ft. Hereford : Hereggest Croft, 30 ft.

Scotland. Peebles : Dawyck, 24 ft.

Picea Breweriana Watson. Siskiyou Mountains of N.W. California and S.W. Oregon. Brewer's Weeping Spruce.

Tree 80-120 ft. high, with a girth of 6-9 ft. Introduced to Kew in 1897. A slow-growing though perfectly hardy tree, remarkable for its long-drooping branchlets. It is a great favourite with planters on account of its elegant habit. Although slow growing it is more vigorous than some of the better known species.

NOTEWORTHY SPECIMENS :

England. Kent : Vernon Holme, 20 ft. Surrey : Kew Gardens, 26 ft. (1938). Sussex : Tilgate, 17 ft. Wakehurst, 14 ft.

Scotland. Wigtown : Monreith, 15 ft. Peebles : Dawyck, 25 ft.

Picea Engelmanni Engelmann. Mountains of Western N. America.

Tree to 150 ft. high and 15 ft. in girth. Introduced in 1864. Apparently rare in cultivation.

NOTEWORTHY SPECIMENS :

England. Kent : Little Hall, 21 ft.

Ireland. Co. Meath : Headfort, 13 ft.

Scotland. Peebles : Dawyck, 42 ft.

Picea glauca Voss. (Syn. *Picea alba* Link.) White Spruce.

N. United States and Canada as far north as Alaska.

Tree attaining 70-100 ft. in height and 9-12 ft. in girth. Introduced into Europe in 1700. One of the most important timber trees of Canada and much used in the production of wood pulp.

NOTEWORTHY SPECIMENS :

England. Oxford : Nuneham Park, 67 ft. Yorks. :

Studley Royal, 65 ft. Hants. : Rhinefield, 64 ft.

Scotland. Perth : Methven Castle, 60 ft.

Picea Glehni Masters. Saghalien, Japan.

Tree up to 100 ft. high. Introduced in 1877 by Maries for Messrs. Veitch. Only small specimens are found in cultivation.

NOTEWORTHY SPECIMENS :

Scotland. Perth : Murthly, 28 ft. Peebles : Dawyck, 16 ft.

Ireland. Co. Meath : Headfort, 21 ft.

Picea jezoensis Carrière. (Syn. *Picea ajanensis* Fischer.)

Hondo Spruce. Widely distributed in N.E. Asia and Japan.

Tree up to 100-150 ft. in height and up to 20 ft. in girth. Introduced in 1861. An important forest tree in Japan. The form usually found in cultivation is the var. *hondoensis* Rehder, with shorter and more curved leaves. The dark glossy green foliage, vividly blue-white beneath, makes this a very attractive spruce.

NOTEWORTHY SPECIMENS :

England. Cornwall : Tregrehan, 65 ft. Glos. : Westonbirt, 57 ft. Sussex : Warnham Court, 55 ft. ; Tilgate, 55 ft.

Scotland. Kincardine : Durris, 57 ft. Moray : Gordon Castle, 56 ft.

Ireland. Co. Wicklow : Powerscourt, 51 ft.

Picea Koyamai Shirasawa. Central Hondo and Korea on mountain slopes.

Narrow pyramidal tree to 60 ft. tall. Introduced about 1914. Small specimens are now found in most up-to-date collections of conifers.

NOTEWORTHY SPECIMENS :

England. Sussex : Warnham Court 18 ft. Hereford : Hergest Croft, 14 ft.

Scotland. Peebles : Dawyck, 26 ft.

Ireland. Co. Leix : Blandsfort, 20 ft. Co. Meath : Headfort, 11 ft. 6 in.

Picea likiangensis Pritzel. (Syn. *P. montigena* Masters.) Native of W. Szechuan, China and Tibet.

Tree 50-100 or more feet high and 10 ft. in girth. Introduced about 1910. In var. *purpurea*. Dallimore and Jackson (Syn. *P. purpurea* Masters, *P. Balfouriana* Rehder and Wilson) the leaves are shorter, about 12 mm. long, adpressed to the upper side of the shoot. Next to *Picea asperata* this is perhaps the commonest of the Chinese spruces in cultivation and very variable.

NOTEWORTHY SPECIMENS :

England. Sussex : Warnham Court, 30 ft. Hereford : Hergest Croft, 21 ft.

Ireland. Co. Leix : Blandsfort, 21 ft. Co. Meath : Headfort, 18 ft. 6 in.

Scotland. Peebles : Dawyck, (var. *purpurea*), 30 ft.

Picea mariana Britton, Sterns and Poggenburg. (Syn. *P. nigra* Link.) Black Spruce. Widely distributed throughout Canada and the N.E. United States. (Fig. 12.)

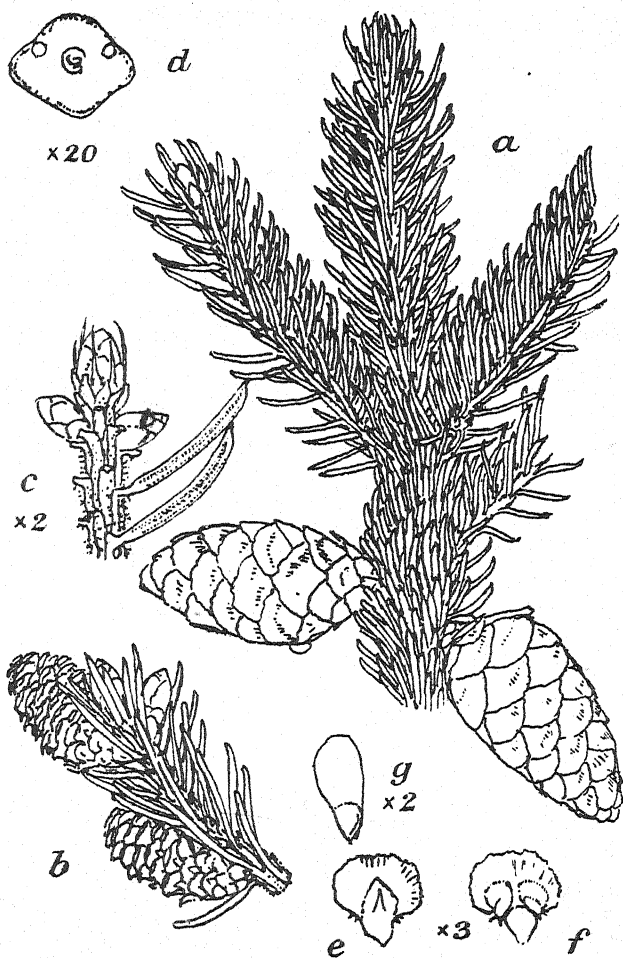


FIG. 12.—*PICEA MARIANA*.

a, spray with two mature cones ; *b*, two young cones ; *c*, winter buds and shoot from beneath ; *d*, section of leaf ; *e*, young cone-scale and bract ; *f*, inner side of cone-scale showing ovules ; *g*, seed.

Tree to 50-75 ft. high and 6-9 ft. in girth. Introduced before 1750. The timber is chiefly used for the manufacture of paper pulp. It grows slowly and is not infrequent in cultivation.

NOTEWORTHY SPECIMENS :

England. Glos. : Westonbirt, 48 ft. Oxford : Nuneham Park, 46 ft. 8 in. Surrey : Bury Hill, 38 ft. Northumberland : Alnwick, 39 ft.

Scotland. Dumfries : Castle Milk, 41 ft. 6 in.

Picea Maximowiczii Regel. Mountains of Japan.

Tree up to 40-50 ft. high. Introduced in 1865. Not common in cultivation.

NOTEWORTHY SPECIMENS :

England. Herts. : Bayfordbury, 12 ft.

Ireland. Co. Leix : Blandsfort, 16 ft.

Scotland. Peebles ; Dawyck, 30 ft.

Picea Omorika Bolle. Servian Spruce. S.E. Europe. (Fig. 18.)

Tree 100 ft. high. Introduced to Kew in 1889. One of the best and hardiest of the spruces. It makes a handsome pyramidal specimen of fairly rapid growth.

NOTEWORTHY SPECIMENS :

England. Glos. : Tortworth, 50 ft. 6 in. Sussex : Nymans, 49 ft. 6 in. Cornwall : Tregrehan, 60 ft. Bedford : Woburn Abbey, 44 ft.

Scotland. Perth : Murthly, 45 ft.

Picea orientalis Carrière. Oriental Spruce. Mountains of Asia Minor and the Caucasus.

Tree up to 180 ft. in height and 12 ft. in girth. Introduced in 1839. One of the best of the ornamental species, which can be grown successfully in all parts of the country.

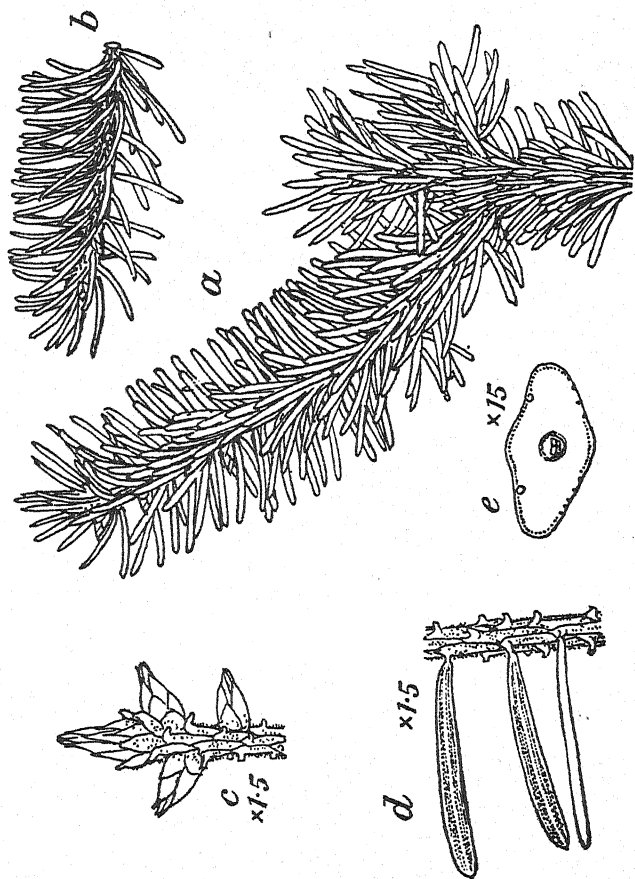


FIG. 13.—*PICEA OMORIKA*.
a, spray from above, *b*, from side; *c*, winter buds; *d*, under-side of shoot and leaves;
e, section of leaf.

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It is undoubtedly one of the most attractive of the spruces with its dense habit and glossy green foliage.

NOTEWORTHY SPECIMENS :

England. Wilts. : Bowood, 91 ft. \times 8 ft. 6 in. *Glos.* : Westonbirt, 85 ft. (1945). *Cornwall* : Penjerick, 90 ft.
Scotland. Lanark : Dolphinton, 112 ft. *Kincardine* :
 Durris, 92 ft. and 85 ft. *Peebles* : Dawyck, 85 ft.

Picea polita Carrière. Tigertail Spruce. Japan.

Tree up to 130 ft. high and 9 ft. in girth. Introduced in 1861. Cultivated solely for ornament. It grows slowly.

NOTEWORTHY SPECIMENS :

England. Cornwall : Pencarrow, 50 ft. *Glos.* : Westonbirt, between 40 ft. and 50 ft.

Picea pungens Engelmann. Mountains of Colorado and New Mexico.

Tree to 80-100 ft. high and 9 ft. in girth. Introduced in 1877. The var. *glauca* Regel, with conspicuously glaucous foliage when young, is largely planted for ornament under the name of Blue Spruce.

NOTEWORTHY SPECIMENS :

England. Sussex : Brook House, 45 ft. *Glos.* : Westonbirt, 40 ft. *Kent* : Little Hall, 38 ft.
Scotland. Argyll : Poltalloch, 44 ft.

Picea rubens Sargent. (Syn. *P. rubra* Link.) Red Spruce. Nova Scotia and eastern United States to N. Carolina.

Tree up to 80 ft. high and 9 ft. in girth. Introduced before 1750. Not common in cultivation.

NOTEWORTHY SPECIMENS :

England. Radnor : Stanage Park, 90 ft. *Norfolk* :
 Merton, 87 ft. *Hants* : Rhinefield, 68 ft.

Picea Schrenkiana Fischer and Meyer. Widely distributed in Central Asia.

Tree up to 100 ft. or more high. Introduced about 1875. Not commonly cultivated.

NOTEWORTHY SPECIMENS :

England. Hereford : Hergest Croft, 34 ft.

Scotland. Peebles : Dawyck, 20 ft.

Ireland. Co. Leix : Blandsfort, 10 ft. 6 in.

Picea sitchensis Carrière. Sitka Spruce. Alaska to California.

Tree 160–200 ft. in height and a trunk of 30 ft. or more in girth. Introduced in 1831. Thriving in the British Isles, especially in moist ground. Much planted in Scotland. The most valuable of all spruce woods, being light and tough.

NOTEWORTHY SPECIMENS :

England. Cornwall : Boconnoc, 86 ft. \times 20 ft. at 3 ft.

Scotland. Perth : Murthly Castle, 132 ft. \times 14 ft. 8 in.

Peebles : Dawyck, 100 ft. \times 13 ft. 2 in. Kincardine : Durris, 113 ft. \times 9 ft.

Ireland. Co. Waterford : Curraghmore, 136 ft. 6 in. \times 15 ft. 9 in.

Picea Smithiana Boissier. (Syn. *P. Morinda* Link.) West Himalayan Spruce. W. Himalaya from Afghanistan to Nepal. (Fig. 14.)

A graceful tree attaining 150 ft. in height. First raised in Britain in 1818 at Hopetoun House, near Edinburgh.

NOTEWORTHY SPECIMENS :

England. Cornwall : Carclew, 105 ft. Wiltshire ; Bo-wood, 100 ft. Radnor : Stanage Park, 97 ft.

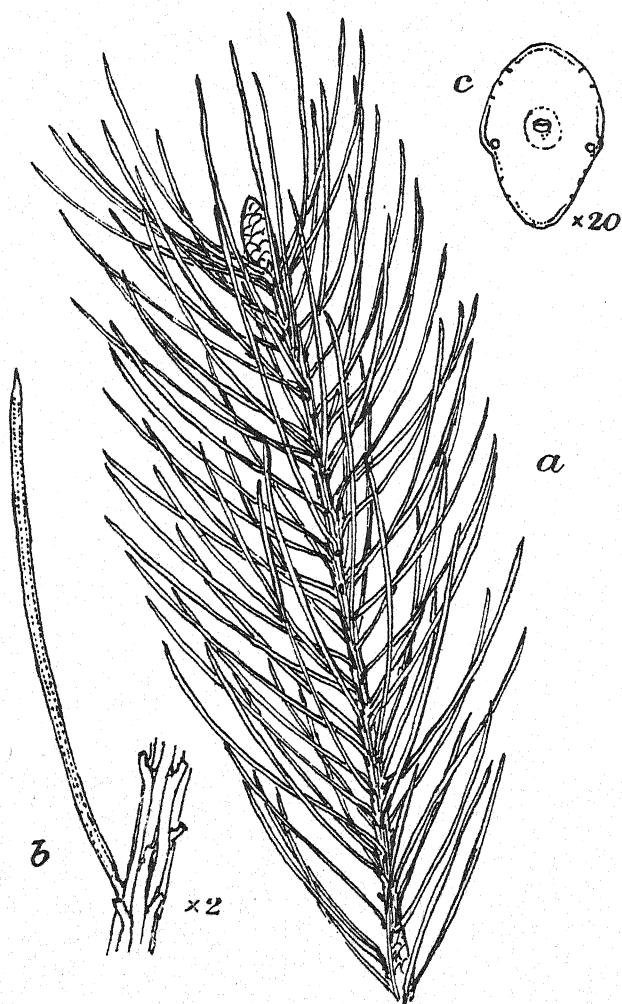


FIG. 14.—*PICEA SMITHIANA*.
a, branchlet with winter bud ; *b*, under-side of leaf and shoot ; *c*, section
of leaf.

Picea spinulosa Henry. (Syn. *P. morindoides* Rehder.)
Sikkim Spruce. Eastern Himalaya.

Tree up to 200 ft. high, with pendulous branches like those of *P. Smithiana*. Introduced into cultivation about 1878. Distinguished from that species by its radially arranged leaves.

NOTEWORTHY SPECIMENS :

England and Wales. Sussex: Leonardslee, 57 ft.
Glos.: Westonbirt, 40 ft. Hants.: Chiltley Place,
Liphook, 40 ft. Denbigh: Bodnant, 36 ft.
Scotland. Perth: Taymouth Castle, 40 ft.
Ireland. Co. Down: Castlewellan, 57 ft.

Picea Wilsonii Masters. (Syn. *P. Watsoniana* Masters.)
Central and W. China.

Tree up to 40 ft. high. Introduced in 1901. Rare in cultivation.

NOTEWORTHY SPECIMENS :

England. Sussex: Wakehurst, 12 ft.; Borde Hill,
32 ft.
Scotland. Peebles: Dawyck, 23 ft.
Ireland. Co. Meath: Headfort, 19 ft. 6 in.

PINUS Linnæus. PINE

Evergreen resin-yielding trees with whorled spreading branches. Leaves of three kinds: (a) primordial leaves on seedling plants, spirally arranged, linear lanceolate and toothed; (b) scale-leaves bearing in their axils the short shoots; (c) adult leaves, needle-like, borne in clusters of 2, 3 or 5, rarely more, or occasionally reduced to 1, and semicircular or triangular in section, surrounded at the base by a sheath of scarious bud-scales, containing either

one or two vascular bundles and usually two or more resin ducts which are either marginal or medial (Figs. 15 and 17). Flowers monœcious, the males axillary catkin-like clustered at the base of the young shoot, composed of spirally arranged, two-celled anthers. Cones woody with persistent scales, generally ripening in two years. Seeds two, usually winged. About 80 species, widely distributed, chiefly in the northern hemisphere.

KEY TO PINUS

LEAVES IN FIVES

- A. Leaf sheaths persistent. Young shoots stout, about 1 cm. diam. Leaves up to 25 cm. long. Buds 25–80 mm. long *P. Montezumæ*
- AA. Leaf-sheaths partly deciduous, the base persisting as a rosette. Young shoots yellowish brown. Leaves 2–4 cm. long with entire margins, speckled with resinous exudations *P. aristata*
- AAA. Leaf-sheaths completely deciduous.
 - B. Leaf margins minutely toothed.
 - C. Young shoots glabrous.
 - D. Shoots glaucous green. Leaves pendulous, 10–18 cm. long. Cones 15–25 cm. long; scales thin, rounded at apex *P. Wallichiana* (Syn. *P. excelsa*)
 - DD. Shoots olive green. Leaves 10–18 cm. long, spreading or drooping, often sharply bent at base. Cones 10–18 cm. long with thick rigid scales, the upper margins slightly reflexed *P. Armandi*
 - DDD. Shoots shining green. Leaves 8–10 cm. long, not bent at the base. Cones 8–15 cm. long with scales convex below the thickened apex *P. peuce*
 - CC. Young shoots more or less conspicuously hairy.
 - D. Shoots with dense shaggy orange-brown hairs. Leaves 5–12 cm. long, entire at the acute apex. Cylindrical tree with dense branches *P. Cembra*
 - DD. Young shoots densely hairy. Leaves 6–12 cm. long, closely toothed to the blunt apex. Pyramidal tree with laxer branches *P. koraiensis*
 - CCC. Young shoots minutely pubescent with brownish hairs.
 - D. Leaves 10–18 cm. long.
 - E. Cone scales spreading outwards towards the apex. *P. Ayacahuite*
 - EE. Cone scales flat or convex towards the apex *P. Holfordiana*
 - DD. Leaves 4–10 cm. long.
 - E. Young shoots with short brown glandular pubescence.

- F. Buds cylindrical, rounded or shortly pointed at the apex. Leaves ending in a sharp point and twisted . . . *P. Lambertiana*
- FF. Buds ovoid, acuminate. Leaves slightly twisted in their upper half, blunt or subacute at apex . . . *P. monticola*
- EE. Young shoots not glandular hairy.
 - F. Young shoots hairy below the insertion of the leaf bases, usually glabrous elsewhere. Buds ovoid, acuminate. Leaves bluish-green on inner surface, 7-12 cm. long. . . *P. Strobus*
 - FF. Young shoots with minute scattered hairs. Buds ovoid not acuminate. Leaves about 5 cm. long, white on the inner surface, blunt at apex . . . *P. parviflora*
- BB. Leaf margins entire or obscurely toothed.
 - C. Leaves 5-8 cm. long, rigid, curved. Shoots pubescent . . . *P. flexilis*
 - CC. Leaves 3-5 cm. long. Shoots as in *P. Cembra*. . . *P. pumila*

LEAVES IN THREES

- A. Leaf-sheaths persistent.
 - B. Leaves 15 cm. or more long.
 - C. Young shoots glaucous. Cones 14-35 cm. long.
 - D. Leaves erect or spreading.
 - E. Buds stout, ovoid, acuminate or cuspidate, 3-4 cm. long. Leaves stout. Seed-wing thick, longer than the seed . . . *P. Coulteri*
 - EE. Buds oblong to ovoid, 3 cm. long. Leaves stout. Seed wing membranous, longer than the seed . . . *P. ponderosa* var. *Jeffreyi*
 - EEEE. Buds narrowly cylindrical, 3 cm. long. Leaves slender, greyish green. Seed-wing thick, shorter than the seed . . . *P. Sabiniana*
 - DD. Leaves very slender, drooping . . . *P. patula*
 - CC. Young shoots not glaucous. Cones 8-15 cm. long . . . *P. ponderosa*
 - BB. Leaves less than 15 cm. long. Winter buds cylindrical-conical.
 - C. Young shoots greenish.
 - D. Winter buds 12-18 mm. long. Leaves bright grass green, soft in texture . . . *P. radiata* (Syn. *P. insignis*)
 - DD. Winter buds 6-18 mm. long. Leaves rigid, dark or yellowish green, often developed from adventitious shoots on the main stem . . . *P. rigida*
 - CC. Young shoots reddish brown. Winter buds 18-25 mm. long. Leaves rigid, dark green . . . *P. attenuata* (Syn. *P. tuberculata*)
 - AA. Leaf sheaths deciduous. Young shoots smooth, not grooved. Leaves rigid, dark green 5-7 cm. long. . . *P. Bungeana*

LEAVES IN PAIRS¹

- A. Winter buds with the tips of the scales recurved.
 - B. Tree with a distinct crown, bare of branches below. Leaves 13-20 cm. long, stout, rigid. *P. Pinaster*
- BB. Tree with umbrella-shaped crown. Leaves 10-12 cm. long, not rigid. *P. Pinea*
- AA. Winter buds with the tips of the scales adpressed.
 - B. Upper trunk reddish. Leaves twisted.
 - C. Young shoots greenish. Leaves 2.5-7 cm. long, glaucous *P. sylvestris*
 - CC. Young shoots glaucous. Leaves bright green, not glaucous, 5-10 cm. long. *P. densiflora*
 - BB. Upper trunk brown.
 - C. Leaves 2.5-5 cm. long.
 - D. Leaves 2.5 cm. long. Winter buds cylindrical, 3-6 mm. long. Young shoots slender, greenish. Cones usually curved, tawny yellow. *P. Banksiana*
 - DD. Leaves 3-5 cm. long. Winter buds cylindrical, 6-12 mm. long. Young shoots brown. Cone not curved. Usually a decumbent shrub *P. Mugo* (Syn. *P. montana*)
 - CC. Leaves 7-15 cm. long.
 - D. Leaves twisted, 3-8 cm. long with basal sheaths 6 mm. long. *P. contorta*
 - DD. Leaves twisted, 8-15 cm. long with basal sheaths 8-12 mm. long. Cone scales with a recurved spine *P. muricata*
 - DDD. Leaves not twisted, with basal sheaths 12 mm. long. Cone scales without a recurved spine.
 - E. Leaves rigid.
 - F. Scales of winter buds brown with white margins.
 - G. Foliage dense erect. Leaves 5-9 cm. long. Cone scales uniform, dull brown throughout. *P. leucodermis*
 - GG. Foliage somewhat spreading. Leaves 10-15 cm. long. Outer surface of cone-scale chocolate-brown in lower half *P. nigra* (Syn. *P. Laricio*)
 - FF. Scales of winter buds whitish throughout. Basal sheath of leaf ending in two long filaments. *P. Thunbergii*
 - EE. Leaves not rigid.
 - F. Young shoots yellowish-brown. Leaves with resin ducts median. Cones tawny yellow, 10-15 cm. long. *P. nigra* var. *calabrica*
 - FF. Young shoots light brown. Leaves¹ with resin ducts marginal. Cones tawny yellow, changing to nut-brown, 5 cm. long *P. tabuliformis* (Syn. *P. sinensis*)

¹ The leaves of *P. tabuliformis* are occasionally in threes.

Pinus aristata Engelmann. Bristle-cone Pine. California to Colorado and Arizona.

A bushy tree 15-40 ft. in height. Introduced in 1863. In cultivation generally a low shrub; the branches densely clothed with leaves which are usually sprinkled with white spots of resin.

NOTEWORTHY SPECIMENS :

England. Herts.: Aldenham, 26 ft. Sussex: Wakehurst, 15 ft. Warnham Court, 13 ft. Borde Hill, 10 ft.

Scotland. E. Lothian: Smeaton Hepburn, 13 ft.

Pinus Armandi Franchet. Central and W. China, Formosa.

Tree attaining 60 ft. in height. Introduced in 1893. In cultivation a small tree with horizontal branches and rather loose foliage. The leaves are often sharply bent near the base.

NOTEWORTHY SPECIMENS :

England. Surrey: Kew Gardens, 45 ft. and 43 ft. (coning freely). Sussex: Warnham Court, 39 ft. Herts.: Bayfordbury, between 20 ft. and 30 ft.

Ireland. Co. Meath: Headfort, 33 ft.

Pinus attenuata Lemmon. (Syn. *P. tuberculata* Gordon.) Knob-cone Pine. S.W. Oregon, California.

A small tree 20-50 ft. high or occasionally taller with a trunk 3-6 ft. in girth. Introduced about 1847 by Hartweg. This species grows slowly in England and is of rare occurrence in collections. It often bears numerous clusters of persistent cones which remain closed for many years.

NOTEWORTHY SPECIMENS :

England. Surrey : Bury Hill, 54 ft. \times 12 ft. 9 in.

Sussex : Leonardslee, 40 ft. \times 2 ft. 6 in.

Wales. Denbigh : Bodnant, 40 ft. \times 6 ft. 6 in. (1944).

Pinus Ayacahuite Ehrenberg. Mexican White Pine.
Mountain slopes in Central America through Mexico,
north to United States boundary.

Tree attaining 100 ft. or more in height. Resembling
P. Wallichiana in habit and foliage ; the cones are distin-
guished by having the basal scales strongly reflexed.

NOTEWORTHY SPECIMENS :

England. Surrey : Bury Hill, 80 ft. *Glos.* : Westonbirt,
75 ft. *Sussex* : Beauport, 70 ft. *Devon* : Bicton, 70 ft.

Pinus Banksiana Lambert. Jack Pine. Common
throughout Canada almost to the Arctic circle.

Tree 25-60 ft. high. Introduced before 1783. A hardy
tree distinguished by its crooked branches, short leaves
and curved cones.

NOTEWORTHY SPECIMENS :

England. Kent : Bedgebury, 56 ft. *Oxford* : Nune-
ham, 51 ft. *Sussex* : Borde Hill, 31 ft. ; Wake-
hurst, 30 ft.

Pinus Bungeana Zuccarini. Lace-Bark Pine. N. and
Central China.

Tree attaining 80-100 ft. in height and 12 ft. in girth.
Introduced into cultivation in 1846. Bark in young trees
smooth, scaling off in patches ; in old trees chalky white.
In this country a slow-growing tree of bushy habit with
sparsely arranged foliage.

NOTEWORTHY SPECIMENS :

England. *Staffs.* : Patshull House, 41 ft. *Surrey* :
Kew Gardens, 39 ft.

Pinus Cembra Linnæus. Arolla Pine. Alps of Central Europe and Siberia. (Fig. 15.)

Tree attaining 180 ft. in height. Introduced by the Duke of Argyll in 1746. A handsome hardy tree of cylindrical habit with dense branches and foliage. Frequently planted in the British Isles. The seeds are edible and are known commercially as pine kernels. In Siberia their collection forms a special industry and thousands of tons are collected annually. *P. pumila* Regel, native of N.E. Siberia and Japan, is probably a dwarf form of *P. Cembra* with shorter leaves and smaller cones.

NOTEWORTHY SPECIMENS :

England. Shropshire : Leaton Knolls, 62 ft. Kent : Knole, 60 ft. Bedford : Woburn Abbey, 58 ft. × 9 ft.

Scotland. Scone : Taymouth Castle, 72 ft. Wigtown : Castle Kennedy, 68 ft. Perth : Abercairney, 64 ft. ; Rossie Priory, 59 ft. Dumbarton : Rosdhu, 60 ft.

Ireland. Co. Leix : Abbeyleix, 65 ft.

Pinus contorta Douglas. Shore Pine. W. North America from Alaska to California. (Fig. 16.)

A tree varying in habit from a stunted bush to a handsome tree 200 feet high. Introduced about 1855. In cultivation seldom exceeding 30 feet. The var. *Murrayana* is a taller tree with broader leaves and larger cones ; it is one of the commonest pines in the Rocky Mountains, but rarely thrives in the British Isles.

NOTEWORTHY SPECIMENS :

England and Wales. Glos. : Westonbirt, 63 ft. × 6 ft. Wilts. : Bowood, 59 ft. Sussex : Warnham Court, 56 ft. 6 in. Denbigh : Bodnant, 78 ft.

Scotland. Perth : Castle Menzies, 72 ft.

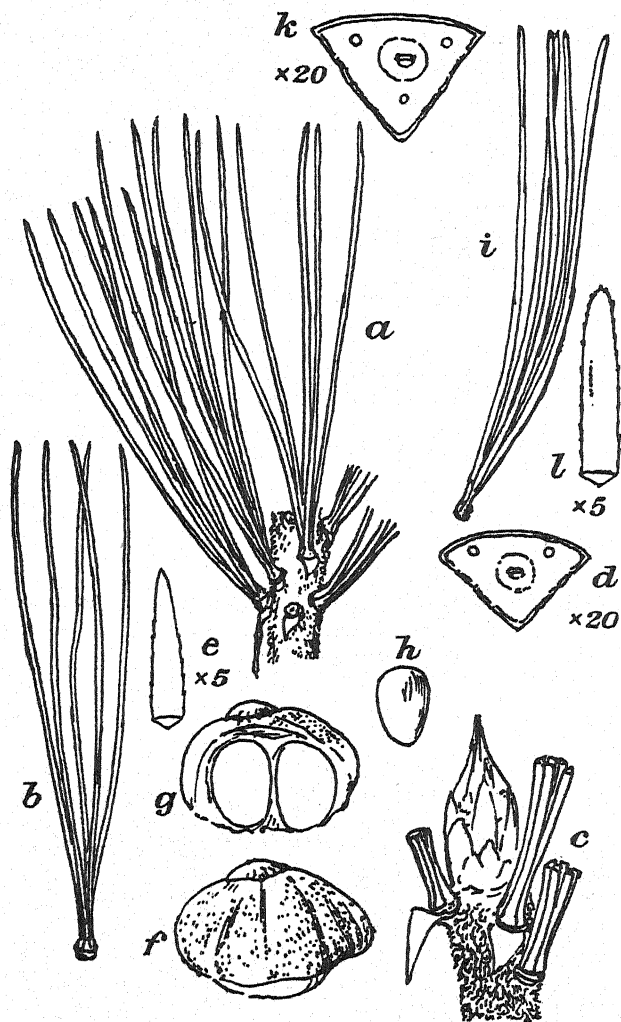


FIG. 15.—*PINUS CEMBRA* and *P. KORAIENSIS*.

Pinus Cembra—a, portion of shaggy shoot with leaves in clusters of five; b, leaf cluster; c, winter bud; d, section of leaf; e, smooth apex of serrulate leaf; f, outer view of cone-scale; g, inner view of cone-scale, with two seeds; h, seed. *P. koraiensis*—i, cluster of five leaves; k, section of leaf with three resin canals; l, serrulate apex of leaf.

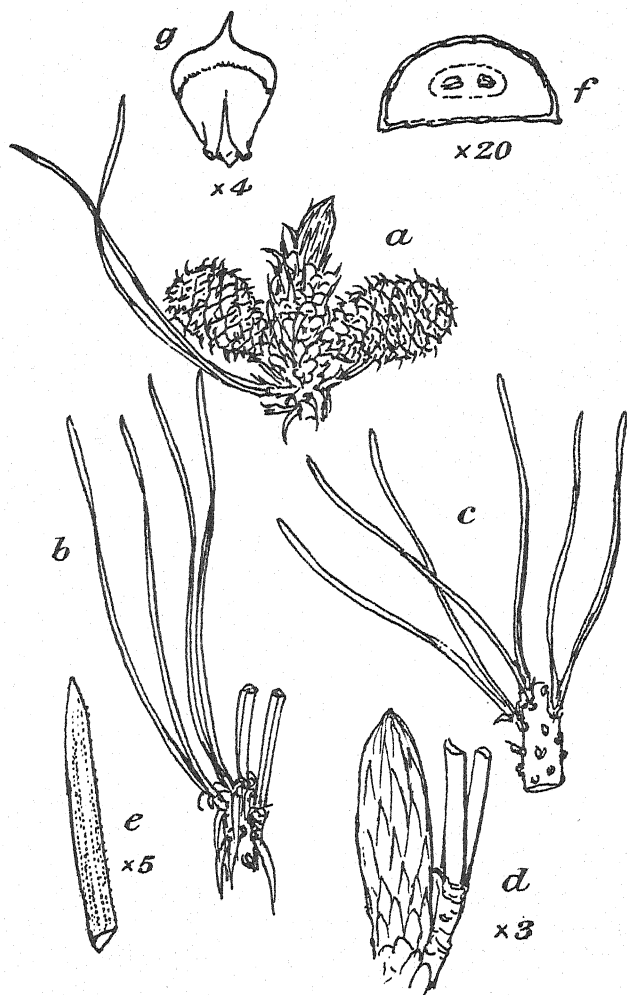


FIG. 16.—*PINUS CONTORTA*.

a, winter bud with two young cones and a leaf-cluster; *b*, part of shoot, showing leaves in pairs and leaf-scales; *c*, older part of shoot; *d*, winter bud; *e*, apex of leaf with serrulate margins; *f*, section of leaf; *g*, young cone-scale with small awl-shaped bract.

Pinus Coulteri D. Don. Big-cone Pine. California on dry mountain-slopes.

Tree attaining 80 ft. in height and 12 ft. in girth. Discovered in the Santa Lucia Mountains by Coulter in 1832 and introduced to Britain by Douglas the same year. It is remarkable for its large massive cones, the woody scales ending in a talon-like hook or claw. Good specimens are occasionally met with in the south and west of England.

NOTEWORTHY SPECIMENS :

England. Hereford : Garnstone Castle, 81 ft. \times 10 ft. 3 in. Staffs. : Patshull, 74 ft. 4 in. \times 10 ft. 8 in. Kent : Kenfield Hall, Canterbury, 75 ft. \times 8 ft. Shropshire : Leaton Knolls, 71 ft. \times 8 ft. 10 in.

Pinus densiflora Siebold and Zuccarini. Japan in mountainous regions.

Tree attaining 70-120 ft. in height and 6-12 ft. in girth. Introduced into cultivation in 1854. Good trees are rarely met with in cultivation. In its red upper trunk it strongly resembles the Scots Pine, from which it differs in its young shoots being glaucous and in its dull green foliage.

NOTEWORTHY SPECIMENS :

England. Bucks. : Dropmore, 70 ft. \times 7 ft. 2 in. Cornwall : Scorrier House, 45 ft. \times 3 ft.; Pen-carrow, 30 ft. \times 3 ft. 9 in.

Pinus flexilis James. Limber Pine. Alberta to California, west to Montana and Texas.

A tree attaining 20-80 ft. high. Introduced by Jeffrey in 1851. This Alpine species grows slowly in the British Isles, assuming a narrow pyramidal outline in youth. Good trees are seldom met with in this country.

NOTEWORTHY SPECIMENS :

England. Surrey : Kew Gardens, 44 ft. \times 3 ft. 7 in.
Bucks. : Dropmore, 30 ft.

Pinus Holfordiana A. B. Jackson. (*P. Ayacahuite* \times *Wallichiana*.) Hybrid origin.¹

A tree similar in habit to *P. Ayacahuite* and *P. Wallichiana*, differing chiefly from the former in the non-reflexed apices of the cone scales, the smaller seeds and the longer, narrower seed-wing, and from the latter in the usually hairy shoots, the broader cones with acute or subacute, not rounded scales.

First noticed in 1932 at Westonbirt, where it appears to have arisen as a natural cross. The original trees have attained a height of 50 ft. and many seedlings have been raised and distributed. It grows rapidly and is quite hardy.

Pinus koraiensis Siebold and Zuccarini. Japan, Korea.
(Fig. 15.)

A tree attaining 100 ft. or more high. Introduced by J. G. Veitch in 1861, it is similar in habit to *P. Cembra*, but slower in growth. Good specimens are rarely seen.

NOTEWORTHY SPECIMENS :

England. Staffs. : Patshull, 40 ft. \times 3 ft. (coning in 1923). Glos. : Westonbirt, 35 ft. (coning in 1922 and 1939). Cornwall : Tregrehan, 27 ft.

Pinus Lambertiana Douglas. Sugar Pine. Oregon and California on mountains from 2,000–9,000 ft. alt.

The largest known pine, attaining a height of 250 ft. or more and a girth of 40 ft. Discovered by Douglas in 1825

¹ See *Gardeners' Chronicle*, March 4th, 1933, for a full account of this hybrid.

on the Multomah River, Oregon, and introduced into cultivation by him in 1827. This pine is distinguished in its native forests by the long outward and downward sweep of the branches; the lowest are often as much as 100 ft. from the ground. The cones, which may be more than a foot long, hang in clusters from the tips of the branches. The Sugar Pine is slow in growth and is represented by single specimens in the older pineta mostly in the south of England.

NOTEWORTHY SPECIMENS :

England. Bucks. : Dropmore, 90 ft. \times 10 ft. 8 in.
 Glos. : Westonbirt, 85 ft. \times 7 ft. Devon : Bicton,
 76 ft. \times 9 ft. 8 in. Norfolk : Holkham, 80 ft. \times
 6 ft. 8 in. Surrey : Bury Hill, 65 ft. \times 9 ft.
 Staffs. : Patshull, 60 ft. \times 6 ft. 6 in.

Pinus leucodermis Antoine. Balkan peninsula (Fig. 18.)

An alpine species allied to *P. nigra* attaining a height of 60 ft. or more. Introduced into cultivation in 1864. It succeeds under similar conditions to the Corsican and Austrian pines, differing from both in its more compact and conical habit, in the dense lustrous foliage and in its slower growth.

NOTEWORTHY SPECIMEN :

England. Sussex : Borde Hill, 20 ft.

Pinus Montezumæ Lambert. Mountains of Mexico.

A tree attaining 70 ft. high. Introduced in 1839. A very variable pine, many of its forms having been described as species. The typical and more tender form is characterized by its long leaves and large cones and is usually only met with in the south and south-west counties. The var. *Hartwegii* is more hardy and has shorter leaves and smaller cones.

NOTEWORTHY SPECIMENS :

England and Wales. Cornwall: Pencarrow, 80 ft. \times 10 ft.; Tregrehan, 60 ft. \times 6 ft. 6 in.; Penjerriek, 50 ft. \times 5 ft. Devon: Bicton, 74 ft. Glamorgan: Roath Park, Cardiff, 38 ft. \times 5 ft. 3 in. Denbigh: Bodnant, 41 ft.

Ireland. Co. Wicklow: Powerscourt, 46 ft. \times 4 ft.; Mount Usher, 50 ft. \times 6 ft. 6 in.

Var. *Hartwegii* :

England. Cornwall: Pencarrow, 60 ft.; Tregothnan, 50 ft. \times 7 ft.

Pinus monticola Douglas. Western White Pine. Pacific coast region of N. America.

Tree attaining 80–175 ft. in height with a trunk 15–25 ft. in girth. Introduced by its discoverer, David Douglas, about 1831. It thrives in many places, especially in Scotland. It resembles the commoner Weymouth Pine, *P. Strobus*, but is more densely pyramidal in habit and has stouter leaves; like that species, is often subject to the attacks of Pine Blister or Weymouth Pine rust.

NOTEWORTHY SPECIMENS :

England. Northants: Althorp, 106 ft. \times 9 ft. Oxford: Nuneham Park, 81 ft. \times 8 ft. Surrey: Knaphill Nursery, 90 ft. \times 6 ft. 6 in. Somerset: Mells Park, 90 ft. \times 9 ft. Bucks.: Dropmore, 80 ft. \times 8 ft. Wilts.: Wilton, 90 ft. \times 8 ft.

Pinus Mugo Turra. (Syn. *P. montana* Miller.) Mountain Pine. Alps of Central Europe. (Fig. 17.)

A tree attaining 60–80 ft. in height or frequently a shrub of more or less prostrate habit. Introduced in 1779. This species includes numerous geographical races which are difficult to classify and appear to be due in many cases to soil and climate. It is fairly common in cultivation,

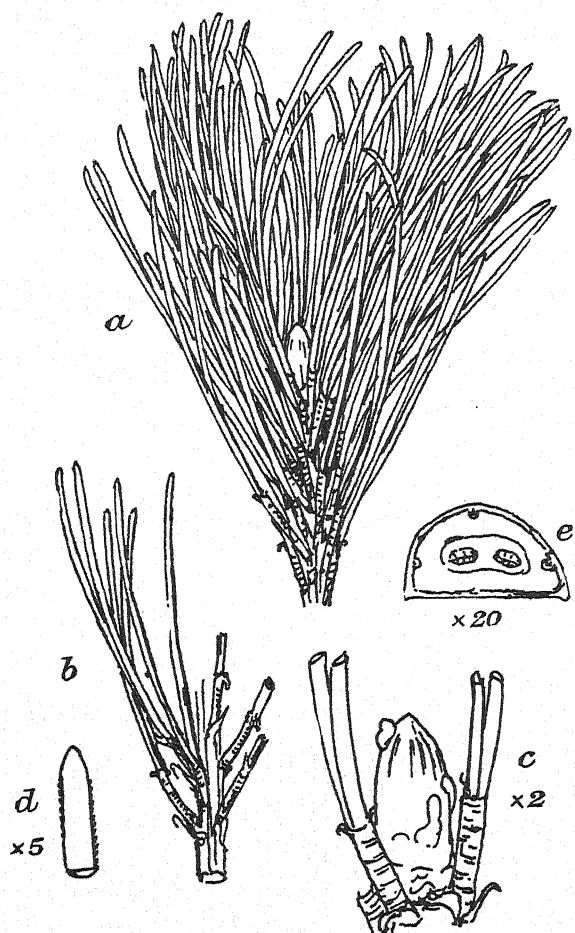


FIG. 17.—*PINUS MUGO*.

a, branch with winter bud ; *b*, portion of shoot with leaves in pairs ;
c, winter bud ; *d*, apex of serrulate leaf ; *e*, section of leaf.

usually occurring either as a shrub or small tree with several erect or ascending stems (var. *rotundata* Hoopes). The Pyrenean form (var. *rostrata* Hoopes), a taller tree with a single undivided stem 60 to 80 ft. high, is also cultivated.

NOTEWORTHY SPECIMENS :

Var. *rotundata* :

England. Berks. : White Knights, Reading, 60 ft. × 6 ft. Herts. : Bayfordbury, 40 ft.

Var. *rostrata* :

Scotland. Peebles : Dawyck, Stobo, 75 ft.

Pinus muricata D. Don. Bishop's Pine. California.

Tree up to about 50 ft., rarely attaining 90 ft. Introduced into cultivation in 1846. In this country usually bearing stout, crooked, irregularly spreading branches which form a compact flat-topped crown. The oblique, often-clustered persistent cones are a striking picture on the older branches.

NOTEWORTHY SPECIMENS :

England. Surrey : Albury Park, 82 ft. × 6 ft. 6 in. ; Claremont, Esher, 82 ft. × 9 ft. Devon : Pitt House, Chudleigh, 66 ft. Hants. : Boldrewood, New Forest, 60 ft. Glos. : Tortworth, 69 ft. × 6 ft.

Pinus nigra Arnold. (Syn. *P. Laricio* var. *austriaca* Loudon.) Austrian Pine. Central and S. Europe, Asia Minor. (Fig. 18.)

Tree attaining 100-150 ft. in height and 12-20 ft. in girth. Introduced in 1759. A very variable species with several geographical varieties or forms. The typical form is a tree with numerous short stout branches and a dense dark crown of foliage ; it is a native of Austria, Servia and Hungary, and is common in cultivation.

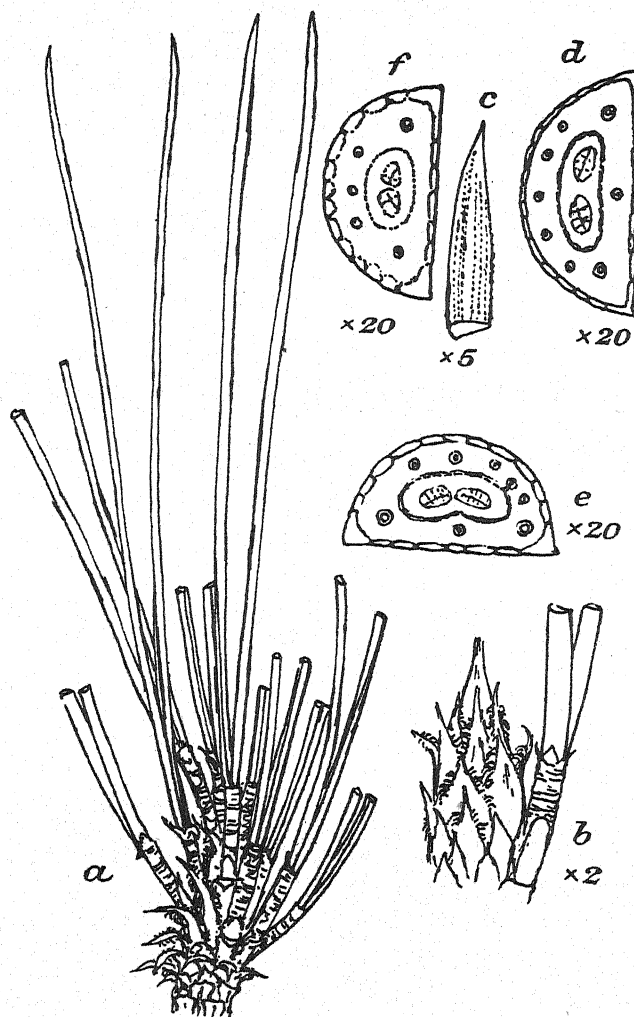


FIG. 18.—*PINUS NIGRA* and *P. LEUCODERMIS*.

Pinus nigra—a, shoot with leaf clusters; b, winter bud and base of a pair of leaves; c, apex of leaf; d, section of leaf. *Var. nigricans*—e, section of leaf, showing thicker hypodermis. *P. leucodermis*—f, section of leaf, with even thicker hypodermis.

Var. *calabrica* Schneider. (Syn. *P. Laricio* var. *corsicana* Loudon.) Corsican Pine. Spain, Corsica, Italy and Greece.

A tall tree with straight stem, slender branches and laxer foliage than in the type.

Var. *caramanica* Rehder. (var. *Pallasiana* Ascherson.) Crimean Pine.

Tree with long, stout, ascending branches forming a broad pyramidal head. Asia Minor.

Var. *cebennensis* Rehder (Syn. *P. Laricio* var. *tenuifolia* Parlatore.) (*P. pyrenaica* Lapeyrouse.) Cevennes and Pyrenees.

A well-marked variety of laxer habit with slender leaves.

The timber of the several varieties of *P. nigra* differs considerably in quality and that of the type is inferior to the Corsican variety when grown in the British Isles. The wood is hard and strong and equal in value to Scots Pine.

NOTEWORTHY SPECIMENS :

Var. *calabrica*.

England and Wales. Radnor: Stanage Park, 130 ft.

Hants: Cuffnells, Lyndhurst, 120 ft. × 8 ft.

Hereford: Eastnor Castle, 111 ft. × 9 ft. 6 in.

Yorks.: Studley Royal, 110 ft. × 7 ft. 6 in.

Surrey: Albury Park, 110 ft. × 11 ft.; Kew Gardens, 90 ft.

Pinus parviflora Siebold and Zuccarini. Japanese White Pine. Japan.

A tree 20-50 ft. high. Introduced by J. G. Veitch in 1861. Young trees pyramidal, with flat heads and wide-spreading branches as they grow older. The ventral surface of the leaves is conspicuously whitened, giving the

foliage a variegated appearance. The small cones have rather few broad leathery scales and are very freely produced.

NOTEWORTHY SPECIMENS :

England. Hereford : Foxley, 35 ft. Somerset : Mells, 43 ft. spread of branches. Hants. : Blackmoor, 35 ft. \times 4 ft. 6 in. and 43 ft. spread of branches. Wilts. : Wilton, 32 ft. Cornwall : Tregrehan, 35 ft. \times 4 ft. 6 in. Beds. : Woburn, 18 ft.

Pinus patula Schlechtendal and Chamisso. Mexico.

A graceful tree 40-60 ft. high, often branching near the ground. Introduced before 1837 and thriving only in the warmer parts of the British Isles.

NOTEWORTHY SPECIMENS :

England. Cornwall : Carclew, 90 ft. \times 7 ft. 6 in. ; Tregrehan, 30 ft. \times 5 ft. 6 in. Devon : Bicton, 64 ft. \times 13 ft. at 2 ft.

Pinus peuce Grisebach. Macedonian Pine. Mountains in Bulgaria and Macedonia. (Fig. 19.)

Tree attaining 100 ft. Introduced in 1864. Allied to *P. Wallichiana*, but differs in its denser, more pyramidal habit and shorter stiffer leaves. It is not infrequent in cultivation.

NOTEWORTHY SPECIMENS :

England. Bucks. : Dropmore, 90 ft. \times 7 ft. Glos. : Westonbirt, 62 ft. \times 6 ft. Sussex : Warnham Court, 50 ft. \times 6 ft. Other trees about the same height at Kew Gardens, Nuneham Park and Woburn.

Ireland. Co. Dublin : Glasnevin, 60 ft. \times 5 ft. Co. Wicklow : Kilmacurragh, 54 ft. \times 7 ft.

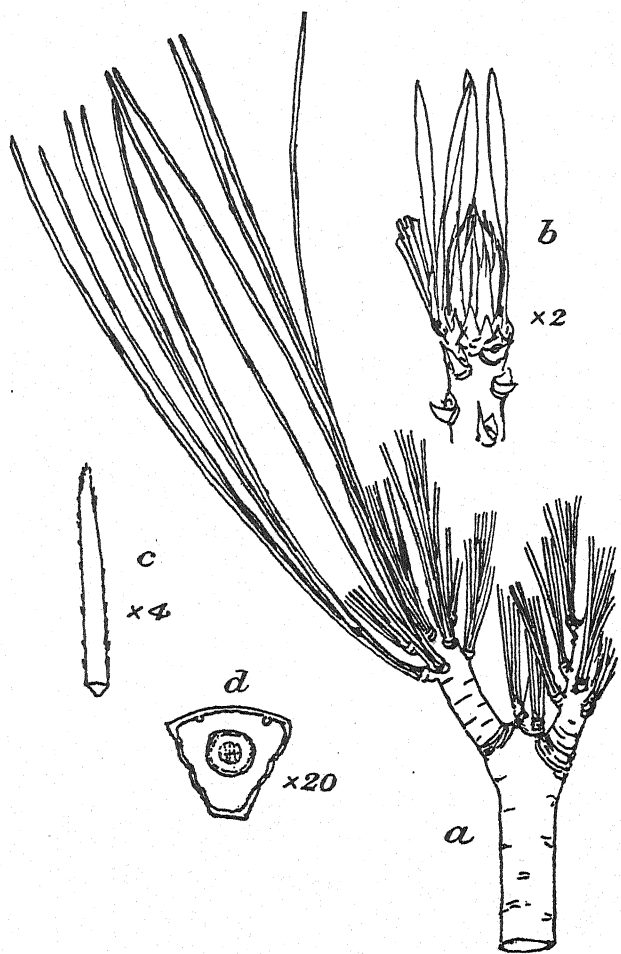


FIG. 19.—*PINUS PEUCE*.

a, part of glabrous shoot with leaves in clusters of five ; *b*, winter bud ;
c, apex of leaf ; *d*, section of leaf showing two small resin canals.

Pinus Pinaster Aiton. Cluster Pine. Mediterranean region eastward to Greece. (Fig. 20.)

Introduced before 1660. A tree attaining 120 ft. high and 6-14 ft. in girth. The trunks of old specimens bare of branches for the greater part of their length. Much cultivated along the coast in south Britain. The thick, reddish-brown bark, deeply fissured is very characteristic.

NOTEWORTHY SPECIMENS :

England. Hereford : Foxley, 109 ft. \times 12 ft. Cornwall : Scorrier, 100 ft. \times 8 ft. 6 in. Sussex : Nymans, Handcross, 85 ft. \times 5 ft. 6 in. ; Sheffield Park, 90 ft. \times 16 ft. Wilts. : Bowood, 86 ft. \times 6 ft.

Ireland. Co. Waterford : Curraghmore, 98 ft. 6 in. \times 9 ft.

Pinus Pinea Linnæus. Stone Pine. Mediterranean region from Portugal to Asia Minor. (Fig. 20.)

A tree up to 80 ft. high with a trunk up to 20 ft. in girth. Introduced to England before 1548. This picturesque tree with its flat-topped or umbrella-shaped crown is a familiar feature of the landscape in south Europe. It grows very slowly in England and is somewhat tender, though trees may be seen in all the southern counties. The seeds have a considerable food value and are known commercially as pine kernels. Both raw and roasted, they are a favourite with vegetarians.

NOTEWORTHY SPECIMENS :

England. Hants. : Hurn Court, Christchurch, 56 ft. \times 13 ft. 7 in. ; Embley Park, 60 ft. 6 in. \times 9 ft. 10 in. Staffs. : Patshull, Wolverhampton, 45 ft. \times 7 ft. 6 in. Surrey : Kew Gardens, 40 ft. \times 7 ft. 6 in.

Ireland. Co. Waterford : Curraghmore, 61 ft. \times 7 ft.



FIG. 20.—*PINUS PINASTER* and *P. PINEA*.

Pinus Pinaster—*a*, branch with winter bud and leaf-clusters; *b*, apex of leaf; *c*, section of leaf; *d*, seed. *P. Pinea*—*e*, branch with winter bud; *f*, apex of leaf; *g*, section of leaf; *h*, cone-scale showing cavities from which seeds have fallen; *i*, seed.

Pinus ponderosa Douglas. Western Yellow Pine. British Columbia to Mexico east to S. Dakota and Texas.

Tree attaining over 200 ft. in height, with a trunk up to 25 ft. in girth. This species spread over an immense area in western N. America consists of a number of geographical races which have been separated as distinct species by various authors, but as they pass into one another and do not occupy isolated areas they are probably best treated as varieties. The type introduced by Douglas in 1827, the var. *Jeffreyi* (Fig. 21) in 1858. This species succeeds best in the south of England, where handsome specimens, 90–100 ft. high, are often met with.

NOTEWORTHY SPECIMENS :

England. Herts. : Bayfordbury, 108 ft. \times 10 ft. 4 in.
Lincoln : Brocklesby Park, 100 ft. \times 8 ft.

Pinus radiata D. Don. Monterey Pine. (Syn. *P. insignis* Douglas.) Monterey County, California, near the sea.

A tree attaining 100 ft. or more high and occasionally 15–20 ft. in girth. Introduced by Douglas in 1833. This pine succeeds best near the sea, especially in the south and south-western counties, where it has proved of great value for shelter and ornament. It is easily recognized by its bright grass-green foliage and whorls of persistent cones which often remain unopened on the tree for many years and extend to the main branches. In Australia, New Zealand and S. Africa, where it has been extensively planted, it grows rapidly; the timber is much employed for butter-boxes.

NOTEWORTHY SPECIMENS :

England. Hants. : Cuffnells, Lyndhurst, 150 ft. \times 11 ft.; Hurn Court, 107 ft. \times 15 ft. Devon : Woodhouse, Uplyme, 120 ft. \times 13 ft. 2 in.

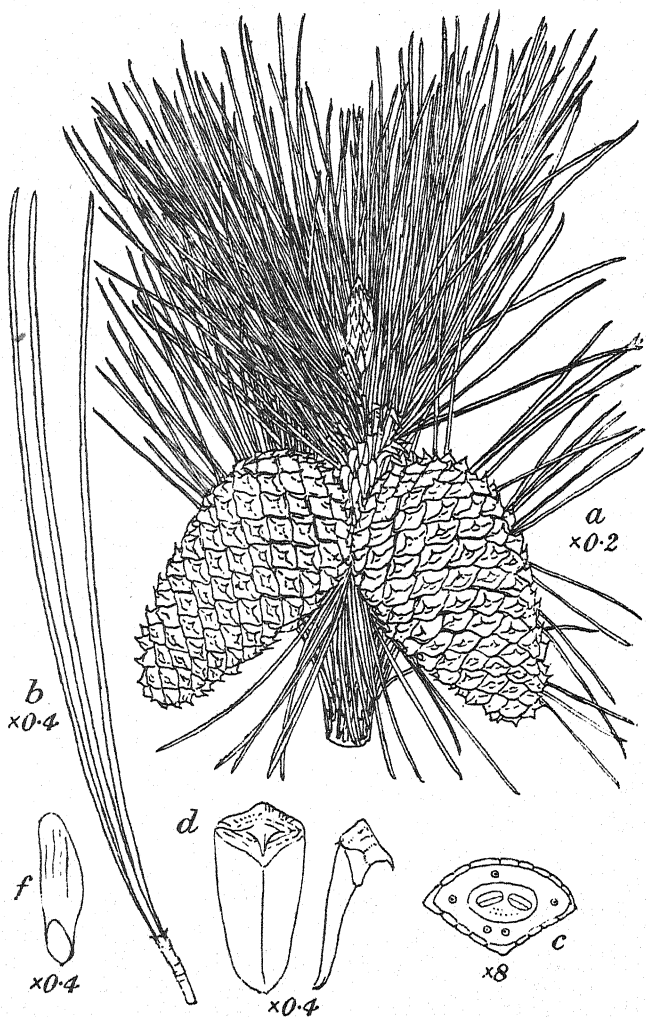


FIG. 21.—*PINUS PONDEROSA*, var. *JEFFREYI*.

a, branch showing winter bud and two cones ; *b*, cluster of three leaves ; *c*, section of leaf ; *d*, cone-scale, outer side, *e*, side-view ; *f*, seed.

Hereford: Foxley, 100 ft. \times 13 ft. There are trees over 100 ft. high in Cornwall at Pencarrow, Tregrehan, Trebah and Lamorran.

Ireland. Co. Waterford: Curraghmore, 113 ft. 6 in.
Co. Limerick: Adare Manor, 100 ft. \times 8 ft. 6 in.

***Pinus rigida* Miller.** Northern Pitch Pine. Eastern N. America.

A tree attaining 50–80 ft. in height with a trunk 6–9 ft. in girth. Introduced about the middle of the eighteenth century. It is remarkable for the formation of adventitious buds which develop tufts of leaves on the trunk. It is not very common in cultivation but old specimens are occasionally met with in collections.

NOTEWORTHY SPECIMENS:

England. Surrey: Bury Hill, 56 ft. 6 in. \times 4 ft.;
Kew Gardens, 51 ft. \times 4 ft. *Glos.:* Westonbirt,
47 ft. \times 4 ft.

***Pinus Sabiniana* Douglas.** Digger Pine. California, foothills of the Sierra Nevada and coast ranges.

Tree 20–80 ft. high and up to 12 ft. in girth. Discovered by Douglas in 1826 and introduced into cultivation by him six years later. It may be recognized by its greyish-green sparsely arranged foliage. In the British Isles it is not quite hardy and is infrequent in cultivation.

NOTEWORTHY SPECIMENS:

England. Kent: Linton Park, 68 ft. \times 7 ft. *Huntingdon:* Orton Hall, 50 ft. \times 9 ft. *Sussex:* Wakehurst, 40 ft. \times 3 ft.

***Pinus Strobus* Linnæus.** Weymouth Pine. Canada, N. United States. (Fig. 22.)

Tree attaining 80–150 ft. with a trunk of 9–12 ft. in girth. Cultivated in England early in the eighteenth

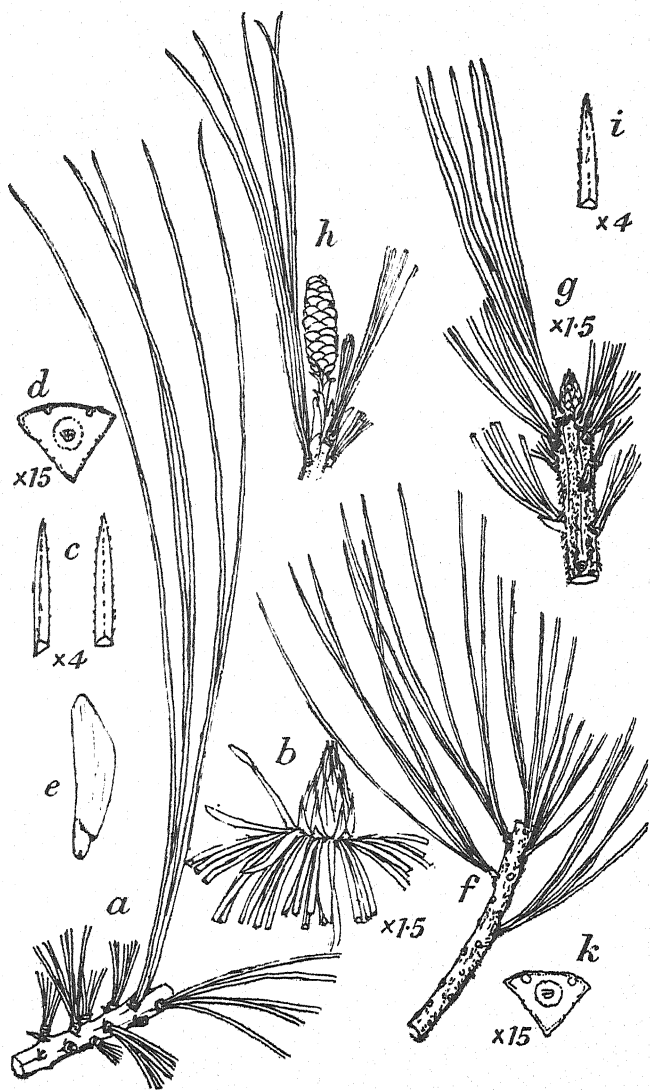


FIG. 22.—*PINUS WALLICHIANA* and *P. STROBUS*.

Pinus Wallichiana—a, shoot with needles in clusters of five; b, winter bud with bases of leaf-clusters; c, apex of serrulate leaf; d, section of leaf; e, seed. *P. Strobus*—f, shoot with needles in clusters of five; g, winter bud and pubescent shoot; h, young cone beside an expanding terminal bud; i, apex of serrulate leaf; k, section of leaf.

century. It owes its common name to its having been largely planted by Lord Weymouth at Longleat, Wilts., early in the eighteenth century. It grows vigorously on sandy soils in the southern half of England; of late years many trees have been ruined by the attacks of Weymouth Pine Rust (*Cronartium rubicolum*) and Weymouth Pine Aphis (*Chermes Strobi*). This pine affords one of the most important timbers of the United States.

NOTEWORTHY SPECIMENS:

- England.* Wilts.: Bowood, 118 ft. \times 9 ft. Hereford: Foxley, 103 ft. \times 12 ft. Hants.: Bassett Wood, 92 ft. \times 8 ft. Oxford: Nuneham, 90 ft. \times 8 ft.
Scotland. Perth: Dunkeld, 86 ft.

Pinus sylvestris Linnaeus. Scots Pine. Scotch Fir. Europe (including Scotland), W. and N. Asia (Fig. 23.)

A tree commonly attaining 70 to 100 ft., but sometimes 150 ft., with a trunk 6-12 ft. in girth. It has a wider distribution than any other pine, thriving in a great variety of soils and climates. Its timber is one of the most important in the British Isles and N. Europe. A number of geographical varieties have been described, but are not very well marked. In Great Britain it is now native only in Scotland, where the remains of once extensive natural forests still exist; in ancient times it was widely distributed over both England and Ireland.

NOTEWORTHY SPECIMENS:

- England.* Cornwall: Enys, 120 ft. \times 9 ft. 2 in., with a clean stem of 50 ft.
Scotland. Argyll: Inveraray, 128 ft., with a clean bole of 112 ft.
Ireland. Co. Waterford: Curraghmore, 117 ft. Co. Meath: Headfort, 117 ft.

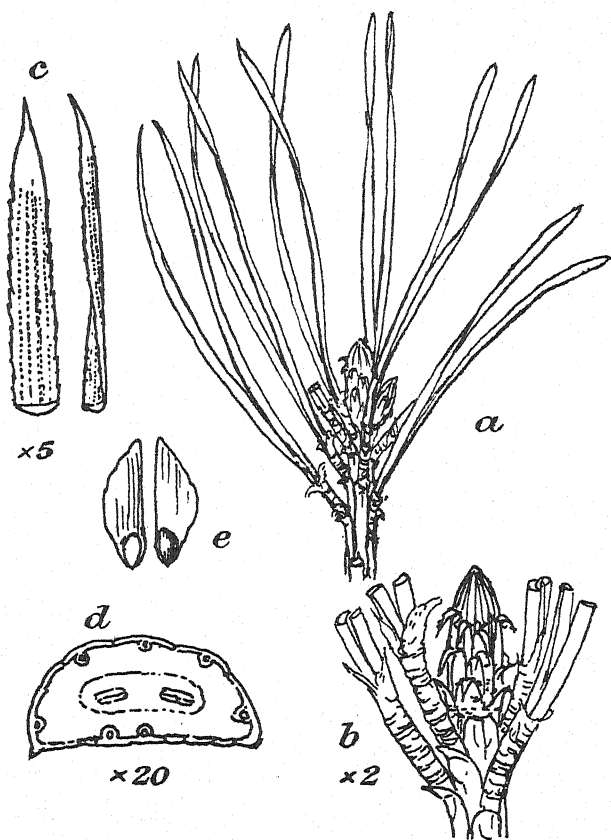


FIG. 23.—*PINUS SYLVESTRIS*.

a, branchlet with winter bud ; *b*, winter bud and bases of leaves ;
c, apex of serrulate leaf ; *d*, section of leaf, showing marginal resin canals ;
e, seeds.

Pinus tabuliformis Carrière. Chinese Pine. (Syn. *P. sinensis* Mayr., not Lambert.) Mountains of Central and W. China and at lower levels in N. China and in Korea.

Attaining 75 ft. in height, but varying in habit according to situation, being sometimes a shapely tree of medium size, or in exposed places it becomes low and flat-headed with gnarled branches. This species is very variable in length of leaf and shape of cone, a number of its forms having been described as species. One of the most distinct of these is the var. *yunnanensis* Shaw (*P. yunnanensis* Franchet), which has slender leaves in threes up to 10 in. long.

NOTEWORTHY SPECIMENS :

England. Sussex : Borde Hill, 24 ft. Herts. : Bayfordbury, 20 ft. Cornwall : Tregothnan, 20 ft.

Ireland. Co. Meath : Headfort, 18 ft.

Pinus sinensis Lambert, formerly considered to be the same species as *P. tabuliformis*, is now included under *P. Massoniana*, a warm-temperate pine. There are no trees in cultivation.

Pinus Thunbergii Parlatore. Japan.

A tree attaining 130 ft. in height and 20 ft. in girth. Introduced into England by J. G. Veitch in 1861. It has been so widely cultivated in Japan from early times that its original geographical range is difficult to define. In England old specimens are often seen in private collections and botanic gardens

NOTEWORTHY SPECIMENS :

England. Cornwall : Tregothnan, 50 ft. \times 5 ft. Glos. : Westonbirt, 50 ft. \times 4 ft. 6 in. Surrey : Bury Hill, 46 ft. 6 in. \times 4 ft. Devon : Woodhouse, Uplyme, 48 ft. \times 3 ft.

Pinus Wallichiana A.B. Jackson. (Syn. *P. excelsa* Wallich.) Bhutan Pine. Himalaya west to Afghanistan and eastward to Nepal at 6,000–12,500 ft. (Fig. 22.)

Tree attaining 50-150 ft. in height. Introduced in 1823 by Lambert and now one of the commonest species in gardens. It makes a handsome lawn tree with its wide spreading branches and drooping cones and foliage.

NOTEWORTHY SPECIMENS :

England. Worcester : Hewell Grange, 97 ft. \times 9 ft. 6 in.

Surrey : Bury Hill, Dorking, 97 ft. \times 7 ft. 6 in.

Shropshire : Leaton Knolls, 96 ft. 6 in. \times 10 ft.

Wilts. : Bowood, 90 ft. \times 10 ft.

Ireland. Co. Wicklow : Powerscourt, 116 ft. \times 12 ft.

LARIX Miller. LARCH

Deciduous trees. Leaves and shoots as in *Cedrus* but foliage deciduous. Flowers monœcious. Male flowers globose or oblong, stalked or sessile. Female flowers erect, subglobose with rosy bracts. Cones with persistent woody scales ripening in one year ; bracts narrowed abruptly into a spine-like apex. About 10 species, widely distributed in the colder regions of the northern hemisphere.¹

KEY TO LARIX

- A. Cones 7.5 cm. or more long ; bracts with long reflexed tails
L. Griffithii
- AA. Cones 1.8-5 cm. long ; bracts straight or slightly reflexed.
 - B. Bracts exceeding the cone scales.
 - C. Leaves deeply keeled on both sides *L. Potanini*
 - CC. Leaves keeled beneath only *L. occidentalis*
 - BB. Bracts not exceeding the cone scales.
 - C. Cones 1.8-3 cm. long.
 - D. Twigs reddish brown. Cones sub-globose ; scales reflexed at apex *L. leptolepis*
 - DD. Twigs pale brown. Cones conical ; scales straight or slightly reflexed at apex *L. decidua*
(Syn. *L. europæa*)
 - CC. Cones 1.2-1.8 cm. long.
 - D. Shoots glabrous ; cone scales with incurved margins
L. laricina (Syn. *L. americana*)
 - DD. Shoots glabrous or hairy ; cone scales with margins straight or somewhat recurved *L. Gmelini*

¹ The genus has been monographed by Ostenfeld and Larsen in *K. Danske Vidensk. Selskab. Biol. Medd.*, IX, 2 (1930).

Larix decidua Miller. (Syn. *L. europæa* De Candolle.)
Common Larch. Alps of Central Europe to N. Russia
and Siberia. (Fig. 24.)

Tree attaining 150 ft. in height and 15 ft. in girth. Introduced before 1629. The common larch is one of our most ornamental conifers. Not only are its delicate green leaves and brightly coloured cones beautiful in spring and early summer, and the rich golden yellow of its foliage charming in autumn, but its bare young twigs brighten up the landscape in winter. It is the most widely grown and probably the most valuable exotic tree in Britain, and the general excellence of its timber has led to its being planted under varying conditions from sea-level to an altitude of 2,000 ft.

NOTEWORTHY SPECIMENS :

England. Northumberland : Alnwick, 130 ft.

Scotland. Argyll : Inveraray, 132 ft. \times 11 ft. ; Stonefield, 120 ft. Perth : Dupplin Castle, 132 ft. \times 10 ft. 6 in. Sutherland : Skibo Castle, 132 ft. \times 7 ft. Bute : Broderick Castle, 100 ft. \times 16 ft. 6 in.

NOTE

Larix eurolepis Henry (*L. decidua* \times *leptolepis*) differs from the latter in its less glaucous branchlets, shorter and narrower leaves with fewer rows of stomata, and the scales of the cone only slightly reflexed. It first appeared at Dunkeld in Perthshire from seeds sown in 1885. Under cultivation this larch grows with great vigour, soon outstripping both parents ; it appears to be free from the attacks of the *Chermes aphid* and also of fungi which are apt to be destructive to the Common Larch. There are trees 60 to 65 ft. high at Blair-Atholl and Dunkeld, Perth.

Larix pendula Salisbury, regarded by Henry as a hybrid (*L. decidua* \times *laricina*), is occasionally met with. There

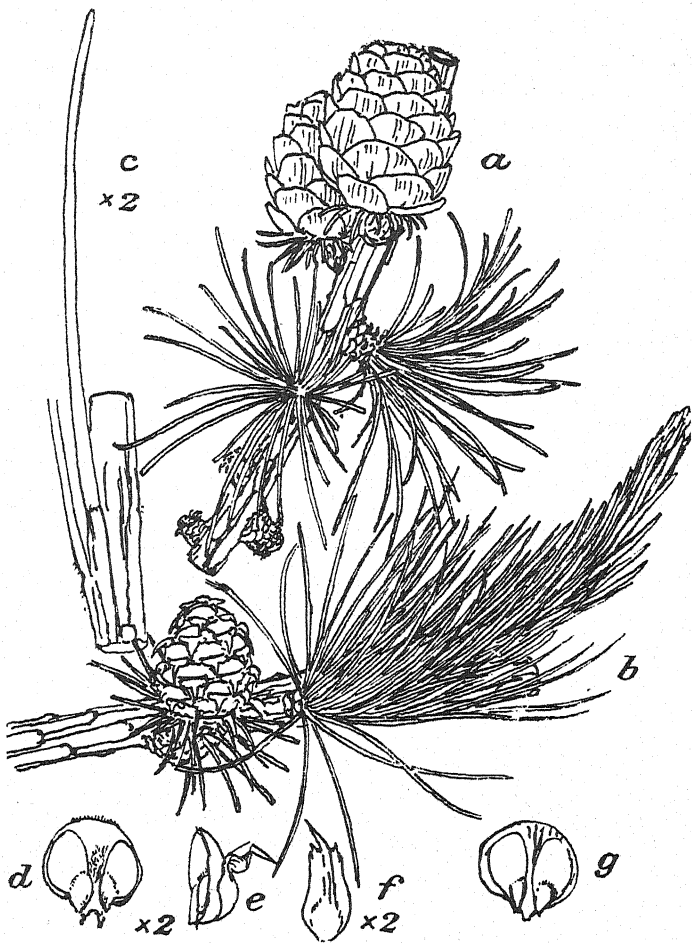


FIG. 24.—*LARIX DECIDUA*.

a, two short shoots and two cones; *b*, young cone and long shoot (in May); *c*, part of shoot with leaf and leaf-bases; *d*, inner face of cone-scale, showing young seeds; *e*, young cone scale and bract, side view; *f*, bract; *g*, mature cone scale and seeds.

is a tree 90 ft. high at Woburn Abbey, Bedfordshire, and smaller specimens at Stanage Park, Hergest Croft, Hereford, Beauport, Sussex; Kew Gardens, Surrey; Murthly, Perth.

Larix Gmelini Litvinov. (Syn. *L. dahurica* Trautvetter.)
Dahurian Larch. N.E. Asia.

Tree attaining 90 ft. high. Introduced in 1827. A widely distributed and very variable species. It is unsuited to our climate and liable to injury by spring frosts. A form with large cones and long leaves from N. China and Korea has been described as a species under the name of *L. Principis Rupprechtii* Mayr (*L. dahurica* var. *P.R.* Rehder and Wilson); another form with hairy shoots and small leaves and cones from the Kurile Islands and Saghalien has been described by Mayr as *L. kurilensis*.

The Olga Bay Larch (*L. olgensis* Henry) from north-east of Vladivostock is a closely allied form with reddish-brown densely hairy shoots; it is very rare in cultivation.

Larix Griffithii Hooker fil. Sikkim Larch. Eastern Himalayas from Nepal to Bhutan.

A tree attaining 60 ft. in height. Introduced in 1848. A tender species succeeding only in the mild climate of S.W. England.

NOTEWORTHY SPECIMEN :

England. Cornwall : Coldrinnick, 75 ft. \times 5 ft. 6 in.

Larix laricina K. Koch. (Syn. *L. americana* Michaux.)
Tamarack. Eastern N. America from the Arctic Circle to Pennsylvania.

Tree attaining 80 ft. or more in height and 6 ft. in girth. Introduced in 1760 by the Duke of Argyll. Less frequently grown than the Old World larches, but is occasionally seen in old collections.

NOTEWORTHY SPECIMENS :

- England.* Sussex: Warnham Court, 63 ft.; Borde Hill, 38 ft. Lincoln: Brocklesby Park, 44 ft.
Scotland. Peebles: Dawyck, 38 ft.

Larix leptolepis Murray. (Syn. *L. Kämpferi* Sargent.)
Japanese Larch. Mountains of Japan.

Tree attaining 100 ft. in height and 12 ft. in girth. Introduced in 1861 by J. G. Veitch. In Britain it grows more rapidly in a young state than the European larch, but the wood does not show the same toughness of fibre.

NOTEWORTHY SPECIMENS :

- England.* Glos.: Tortworth Court, 60 ft. \times 6 ft. 4 in.
Cornwall: Tregrehan, 65 ft. Lincoln: Brocklesby Park, 68 ft.
Scotland. Ayr: Kilkerran, 80 ft.; Blairquhan, 65 ft.
Kirkcudbright: Munches, 75 ft. Argyll: Benmore, 76 ft.; Inveraray, 74 ft. Perth: Blair-Atholl, 73 ft.; Dunkeld, 68 ft.
Ireland. Co. Meath: Headfort, 70 ft.

Larix occidentalis Nuttall. Western Larch. British Columbia to Montana and Oregon.

Tree attaining 150 ft. in height and 15 ft. in girth. Introduced to Kew from the Arnold Arboretum in 1881. Unsatisfactory for forestry purposes in Britain. Timber similar to European larch and largely employed in its native country for building.

NOTEWORTHY SPECIMENS :

- England.* Sussex: Warnham Court, 62 ft. Surrey: Kew, 57 ft.
Scotland. Moray: Gordon Castle, 46 ft. Ayr: Culzean, 40 ft. Peebles: Dawyck, 42 ft.

Larix Potanini Batalin. (Syn. *L. thibetica* Franchet.)
Chinese Larch. Western China.

Tree attaining 90 ft. in height. Introduced in 1904 by Wilson. Young trees are making good growth in this country. One of the most valuable coniferous timbers in W. China.

NOTEWORTHY SPECIMENS :

England. Sussex : Borde Hill, 19 ft.

Wales. Denbigh : Bodnant, 22 ft.

Scotland. Peebles : Dawyck, 18 ft.

Ireland. Co. Meath : Headfort, Kells, 20 ft.

PSEUDOLARIX Gordon

Resembling *Larix* in its deciduous foliage, but male catkins clustered in short spurs and female cones with deciduous scales. One species in China.

Pseudolarix amabilis Rehder. (Syn *P. Fortunei* Mayr.)
Golden Larch. East China. (Fig. 25.)

Tree attaining 130 ft. in height and 8 ft. in girth. Introduced in 1853 by Fortune. A handsome and fairly hardy conifer of broad pyramidal habit. It is slow in growth and good specimens may be occasionally met with in southern England.

NOTEWORTHY SPECIMENS :

England. Glos. : Tortworth, 50 ft. Cornwall : Scorrier, 42 ft. Surrey : Kew Gardens, 42 ft.

CEDRUS Link. CEDAR

Evergreen trees, pyramidal in habit when young, often developing massive trunks and tabuliform branches when mature. Branchlets of two kinds, long terminal shoots bearing scattered leaves, and short spur-like shoots bearing



FIG. 25.—*PSEUDOLARIX AMABILIS*.

a, branch with female cone ; b, branch with clusters of male cones ; c, male cone ; d, stamen ; e, leaf ; f, section of leaf, showing two resin canals ; g, cone-scale with two seeds ; h, bract of cone-scale.

tufts of needle-like rigid leaves. Flowers monœcious, terminal. Male flowers in erect catkins. Female cones erect, barrel-shaped, with deciduous scales, ripening in two years. Four closely related species sometimes considered to be geographical forms of one species.

KEY TO CEDRUS

- A. Leading shoot stiff; upright or spreading. Leaves 2-3 cm. long.
 B. Branchlets densely pubescent. Leaves usually less than 2.5 cm., often glaucous in cultivation *C. atlantica*
- BB. Branchlets glabrous or nearly so. Leaves 2.5-3 cm. long, dark green *C. Libani*
- AA. Leading shoot pendulous. Leaves up to 5 cm. long *C. Deodara*

Cedrus atlantica Manetti. Atlas Cedar. Atlas Mountains. (Fig. 26.)

Tree up to 120 ft. in height. Introduced about 1845. In its native habitat the foliage may be either glaucous or dark green. Thrives all over the British Isles. The variety with glaucous foliage (var. *glauca* Hort.) is one of the most effective and widely grown conifers and makes a handsome lawn tree.

NOTEWORTHY SPECIMENS :

England. Wilts.: Bowood, 135 ft. × 16 ft. 10 in.
Sussex: Nymans, 105 ft. *Glos.:* Westonbirt, 102 ft. × 12 ft. 6 in. with a spread of 62 ft.

Cedrus brevifolia Henry. Cyprus.

Differs from the other cedars in its more stunted habit, shorter leaves, about 1 cm. long and smaller cones. Introduced into England in 1879. Small plants in cultivation.

NOTEWORTHY SPECIMEN :

England. *Sussex:* Borde Hill, 24 ft.

Cedrus Deodara Loudon. Deodar. Himalayas.
(Fig. 26.)

Introduced in 1831. Tree attaining 200 ft. in height and 35 ft. in girth. Leading shoots and branchlets of young trees pendulous. It is less hardy than the other cedars, but is the most elegant in habit. There are many fine Deodars in the south and south-west of England.

NOTEWORTHY SPECIMENS :

England. Sussex: Beauport, 106 ft. \times 11 ft. Wilts.: Stourhead, 103 ft. \times 9 ft. Glos.: Westonbirt, 100 ft. \times 10 ft.

Cedrus Libani Loudon. Cedar of Lebanon. Syria, Asia Minor. (Fig. 26.)

Tree attaining 70-100 ft. in height and 16-25 ft. in girth. Probably introduced during the latter half of the seventeenth century. The Lebanon cedar is one of our most picturesque evergreens. They are stately trees with massive trunks and widely spreading branches which lend an aspect of dignity and beauty to many parks and gardens in the south of England.

NOTEWORTHY SPECIMENS :

England. Sussex: Petworth, 115 ft. \times 16 ft. 10 in.; Cowdray Park, 110 ft. \times 18 ft. 9 in.; Goodwood, 103 ft. Surrey: Albury Park, 123 ft. \times 18 ft. and 121 ft. \times 16 ft.; Pains Hill, 117 ft. \times 19 ft. and 114 ft. \times 30 ft. Hants.: Highclere Park, 125 ft. \times 23 ft. (1925). Herts.: Beechwood, 111 ft. \times 29 ft.; Bayfordbury, 90 ft. \times 29 ft. Wilts.: Wilton Park, 110 ft. \times 25 ft.; Bowood, 113 ft. \times 17 ft. Hereford: Kinnersley Castle: 124 ft. \times 16 ft.; Eastnor Castle, 113 ft. \times 16 ft. Berks.: Park Place, Henley-on-Thames, 112 ft. \times 21 ft.

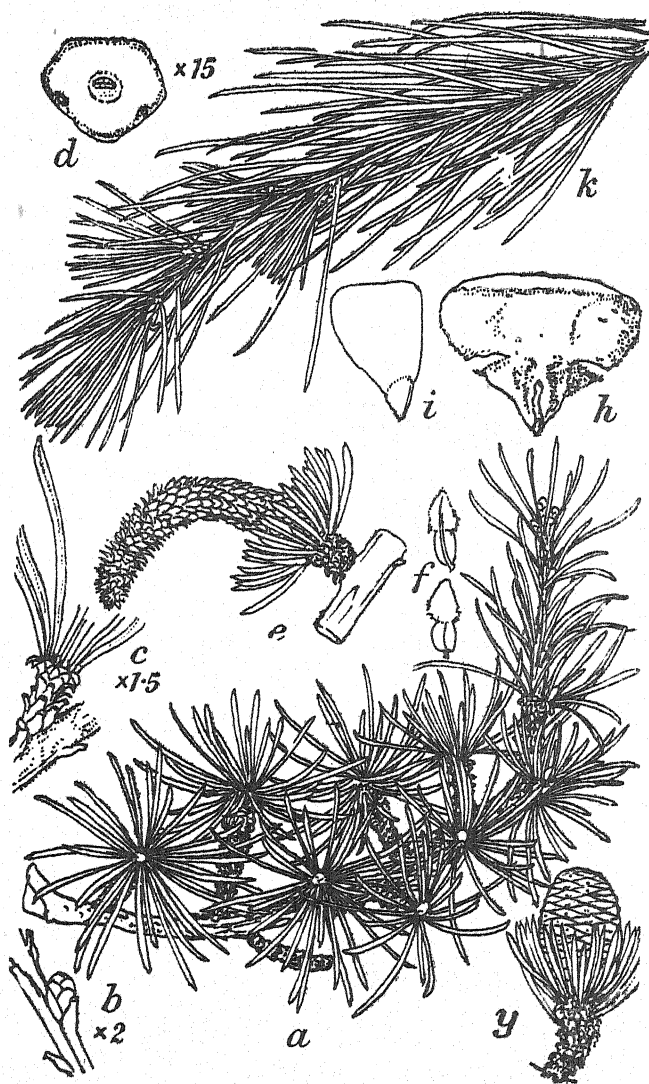


FIG. 26.—*CEDRUS LIBANI*, *C. ATLANTICA*, *C. DEODARA*.
Cedrus Libani—*a*, spray with many short shoots and one long shoot;
b, winter bud; *c*, leaf and leaf-bases on short shoot; *d*, section of leaf,
 showing two resin canals. *C. atlantica*—*e*, short shoot bearing male
 cone; *f*, stamens; *g*, young female cone; *h*, cone-scale with a small
 slender bract; *i*, seed. *C. Deodara*—*k*, spray.

PSEUDOTSUGA Carrière

Habit and foliage of *Abies* with slightly prominent oval leaf-scars. Buds fusiform, resembling those of a beech. Flowers monœcious. Male catkins axillary, cylindrical. Female cones pendulous, ripening in one year. Bracts exserted, with the apex three-lobed, the central lobe the longest and spine-like. About 7 species; N. America and E. Asia.

KEY TO PSEUDOTSUGA

- A. Leaves entire at apex, 25-30 mm. long. Cones 5-10 cm. long.
 - B. Shoots pubescent. Foliage dark green. Leaves thin, flat beneath with a fragrant pineapple odour. Cones 8-10 cm. long, with straight bracts . . . *P. taxifolia* (Syn. *P. Douglasii*)
 - BB. Shoots pubescent or glabrous. Foliage more or less glaucous or bluish green. Leaves thicker, convex beneath, with strong turpentine odour. Cones 5-8 cm. long with spreading or reflexed bracts . . . *P. glauca*
- AA. Leaves notched at apex, about 25 mm. long. Cones 4 cm. long with reflexed bracts . . . *P. japonica*

Pseudotsuga taxifolia Britton. (Syn. *P. Douglasii* Carrière.) Oregon Douglas Fir. Widely distributed in the Pacific Coast from British Columbia to California. (Fig. 27.)

Tree attaining 250-300 ft. in height and 40 ft. in girth. Discovered by Menzies at Nootka Sound in 1797, but not introduced into Britain until thirty years later, when plants were raised by the Horticultural Society of London from seeds sent home by Douglas. In this country it has been largely planted both for forestry and ornamental purposes. It is rapid in growth and in sheltered situations on a deep and fertile soil it becomes a stately tree furnished with branches to the ground. It yields strong and durable timber which is employed for a great variety of purposes and is known commercially as Oregon Pine.

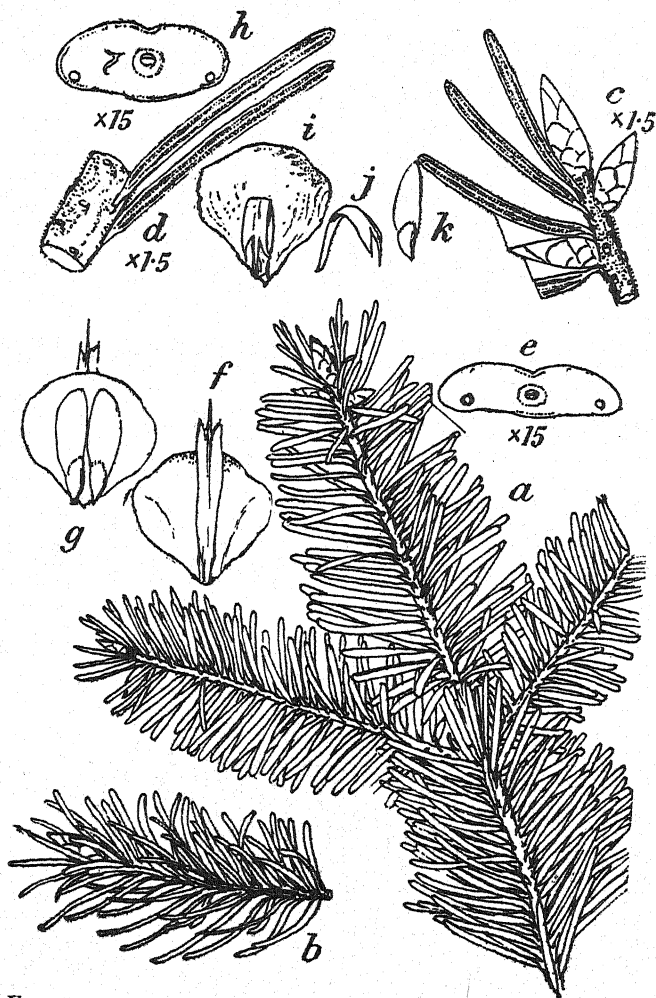


FIG. 27.—*PSEUDOTSUGA TAXIFOLIA* and *P. GLAUCA*.

Pseudotsuga taxifolia—a, spray from above, b, from the side; c, winter buds and leaves, under-side; d, part of shoot and under-leaf surface; e, section of leaf; f, cone-scale with straight bract; g, inner side of cone-scale with recurved bract; h, section of leaf; i, cone-scale with recurved bract; j, bract, side view; k, seed.

NOTEWORTHY SPECIMENS :

- England and Wales.* Devon : Endsleigh, 150 ft.
Surrey : Cowdray Park, 130 ft. \times 9 ft. ; Bury
Hill, 112 ft. \times 12 ft. Montgomery : Powis Castle,
Welshpool, 168 ft. \times 11 ft.
Scotland. Perth : Murthly, 132 ft. \times 12 ft. Argyll :
Inveraray, 125 ft. \times 10 ft. Kincardine : Durris,
122 ft. \times 15 ft. Kirkcudbright : Munches, 124 ft.
 \times 11 ft.

Pseudotsuga glauca Mayr. (Syn. *P. Douglasii* var. *glauca*
Mayr.) Colorado Douglas Fir. Rocky Mountains,
Colorado to Mexico. (Fig. 27.)

A tree of smaller dimensions than the Oregon Douglas
Fir, rarely exceeding 150 ft. in height. Introduced since
1884. Much hardier than the Oregon Douglas Fir, but
owing to its slower growth has no value as a timber tree
in this country. It is, however, worth cultivating as an
ornamental conifer on account of its glaucous foliage.

NOTEWORTHY SPECIMENS :

- England.* Devon : Pitt House, Chudleigh, 71 ft. \times 9 ft.
6 in. Lincoln : Brocklesby Park, 68 ft. \times 3 ft.
Scotland. Midlothian : Oxenfoord Castle, 7 ft. \times 6 ft.

Pseudotsuga japonica Beissner. Japanese Douglas Fir.
S.E. Japan.

A tree attaining 70-100 ft. in height and 6-15 ft. or
more in girth. Introduced into England in 1910 by Mr.
H. Clinton-Baker. This species is comparatively slow
growing, and is still scarce in cultivation.

NOTEWORTHY SPECIMENS :

- England.* Herts. : Bayfordbury, 17 ft. Sussex :
Leonardslee, 13 ft. Devon : Endsleigh, 30 ft.
 \times 3 ft. 9 in.

TSUGA Carrière. HEMLOCK

Evergreen trees with horizontal branches. Branchlets often pendulous at the tips. Leaves flattened, linear, usually two-ranked with two whitish bands below. Leaf stalks slender, short, adpressed to the shoot. Flowers monœcious. Male catkins globose, axillary. Female cones terminal on lateral shoots, ovoid or oblong with about 20 persistent concave woody scales, ripening in one year. About 10 species; temperate, N. America, Japan, China and Himalaya.

KEY TO TSUGA

- A. Leaves flat, 2 ranked, grooved above with pale bands beneath. Cones 15-30 mm. long.
 - B. Margin of leaves entire.
 - C. Young shoots glabrous, leaves notched at apex, 5-20 mm. long. *T. Sieboldii*
 - CC. Young shoots hairy.
 - D. Leaves 5-15 mm. long, notched at apex. Shoots hairy all over, reddish brown. *T. diversifolia*
 - DD. Leaves 15-25 mm. long. Young shoots light yellowish-brown or grey, hairy chiefly in the grooves or on the upper side only.
 - E. Leaves notched at the apex with inconspicuous pale bands below. Cone scales suborbicular. *T. chinensis*
 - EE. Leaves rounded or obscurely notched at apex with conspicuous pale bands below. Cone scales oblong. *T. caroliniana*
- BB. Margin of leaves minutely toothed, young shoots hairy.
 - C. Tree without distinct leader (in cultivation). Leaves 8-18 mm., long, narrowing towards the apex, with pale bands of stomata beneath about the width of the green border. Cones short stalked, 15-20 mm. long. *T. canadensis*¹
 - CC. Tree with a spire-like leader. Leaves 6-18 mm. long, uniform in width, with pale bands of stomata beneath which are broader than the green border. Cones sessile, 20-25 mm. long. *T. heterophylla*
 - CCC. Small tree or shrub with drooping branches. Leaves 20-25 mm. long, tapering from base to apex, conspicuously white beneath. *T. dumosa* (Syn. *T. Brunonian*)

¹ A tree which though spire-like in its native habitat is always round-headed in Great Britain.

AA. Leaves radially arranged.

B. Leaves rounded or keeled above, greyish green with indistinct pale bands of stomata on both surfaces. Cones cylindric oblong 5-7 cm. long . *T. Mertensiana* (Syn. *T. Pattoniana*)

BB. Leaves flat and grooved above, dull green, with broken white lines of stomata near the apex of the upper surface, minutely toothed. Cones cylindric oblong, 5 cm. long *T. Jeffreyi*

Tsuga canadensis Carrière. Eastern Hemlock. New Brunswick and Wisconsin south to Alabama. (Fig. 28.)

Tree occasionally attaining 60-100 ft. in height and 9-12 ft. in girth. Native of Canada east of the Rocky Mountains and of the Eastern United States.

Introduced into England by Peter Collinson in 1736 ; widely planted as an ornamental conifer.

Wood employed in its native country for constructive purposes, but less generally useful and coarser than the Western Hemlock.

NOTEWORTHY SPECIMENS :

England. Hants. : Boldrewood, 87 ft. Shropshire :
Leaton Knolls, 85 ft. \times 8 ft. Yorks. : Studley
Royal, 83 ft. \times 12 ft. Wilts. : Wardour Castle,
71 ft. \times 11 ft. 5 in.

Scotland. Stirling : Buchanan Castle, 80 ft. \times 9 ft. 6 in.

Ireland. Co. Waterford : Curraghmore, 70 ft. \times 8 ft.

Tsuga caroliniana Engelmann. Carolina Hemlock.
Mountains of S.W. Virginia to Georgia.

Tree attaining 70 ft. Introduced in 1886 into England, where it grows very slowly and only small specimens are known.

NOTEWORTHY SPECIMEN :

England. Sussex : Wakehurst Place, 18 ft.

Tsuga chinensis Pritz. Chinese Hemlock. Widely distributed in Central and Western China.

Tree 100 ft. high. Introduced by Wilson for Messrs.

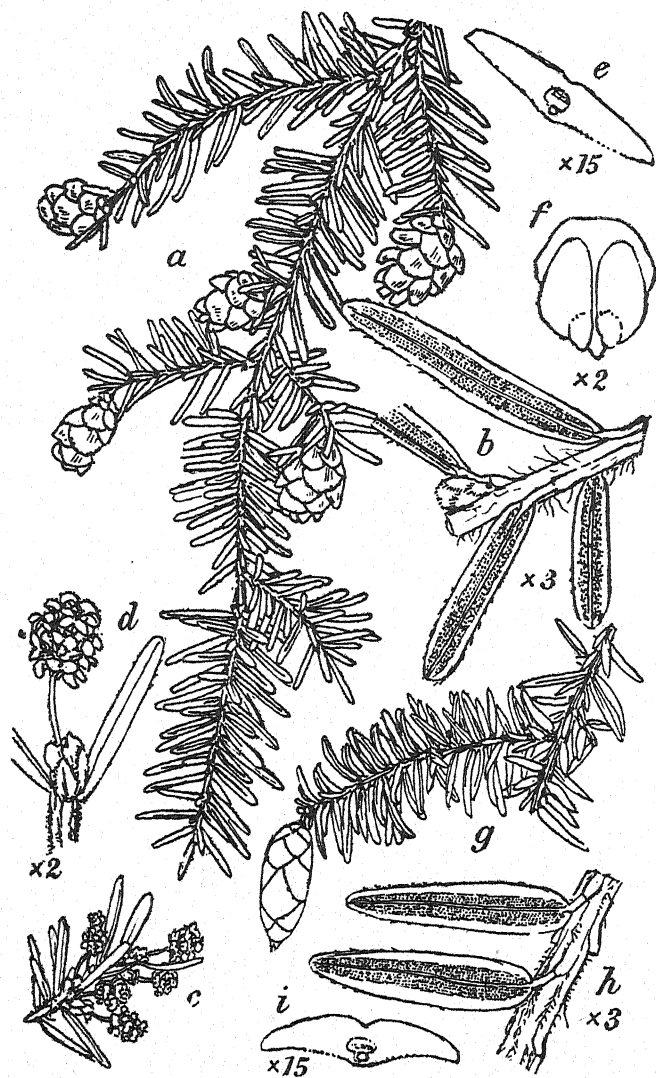


FIG. 28.—*TSUGA HETEROPHYLLA* and *T. CANADENSIS*.
Tsuga heterophylla—a, spray with female cones b, under-side of shoot with bud and leaves showing bands of stomata; c, branchlet with cluster of male cones; d, male cones; e, section of leaf with central resin canal below the vascular bundle; f, cone-scale with two seeds. *T. canadensis*—g, branch with cone; h, under-side of shoot and leaves; i, section of leaf.

Veitch in 1900; it has not so far attained to any size in this country.

NOTEWORTHY SPECIMENS :

England and Wales. Glos.: Westonbirt, 16 ft. Den-
high: Bodnant, 21 ft. with spread of 25 ft.

Scotland. Peebles: Dawyck, 14 ft.

Ireland. Co. Meath: Headfort, 15 ft.

The closely related *Tsuga yunnanensis* recently introduced from Western China, differs from *T. chinensis* in the narrower, obtuse leaves which are not notched at the apex and in the cones which have fewer scales, slightly reflexed at apex.

Tsuga diversifolia Masters. Northern Japanese Hemlock.

Tree attaining 50-80 ft. high in Japan, where it has a more northerly distribution than *T. Sieboldii*. Introduced into England in 1861 and usually only forming a shrub in this country

NOTEWORTHY SPECIMENS :

England. Norfolk: Fulmodestone, 17 ft. Sussex:
Leonardslee, 15 ft.

Scotland. Peebles: Dawyck, 20 ft.

Ireland. Co. Meath: Headfort, 12 ft.

Tsuga dumosa Eichler. (Syn. *T. Brunoniana* Carrière.)

Tree attaining 120 ft. in height, widely distributed in the Himalayas. Introduced into England in 1838. It thrives only in the milder parts of Britain; good specimens are occasionally seen in the south and western counties.

NOTEWORTHY SPECIMENS :

England. Cornwall: Boconnoc, 70 ft., with a spread of over 60 ft.; Tregrehan, 50 ft. Surrey: Bury Hill, 54 ft. Bucks.: Dropmore, 48 ft.

***Tsuga heterophylla* Sargent.** (Syn. *T. Albertiana* Sénéclauze.) Western Hemlock. Western America from S.W. Alaska to British Columbia and Northern California. (Fig. 28.)

Tree attaining 200-250 ft. in height and 20 ft. in girth. Introduced by Jeffrey in 1851. A graceful tree of rapid growth; extensively planted on account of its landscape value. Succeeds best in moister soils. Timber hard, tough and close-grained; in great demand for building and general constructive work in its native land where it yields the most important pulpwood. Bark used for tanning.

NOTEWORTHY SPECIMENS :

England and Wales. Wilts. : Stourhead, 100 ft. \times 9 ft.
Cornwall : Carclew, 100 ft. \times 9 ft. 8 in. Denbigh :
Bodnant, 112 ft.

Scotland. Perth : Murthly Castle, 118 ft. \times 9 ft.
Ross : Duncraig Castle, 115 ft. \times 7 ft. Kincardine :
Durris, 102 ft. Kirkcudbright : Munches, 106 ft. \times 9 ft.

***Tsuga Jeffreyi* Henry.** (*T. heterophylla* \times *Mertensiana*.)

Somewhat intermediate in character between *T. heterophylla* and *T. Mertensiana* and possibly of hybrid origin. Said to have been raised at Edinburgh from seeds collected in the Mount Baker range in British Columbia by Jeffrey in 1851. Small trees of considerable age and of very slow growth are occasionally met with in English collections.

NOTEWORTHY SPECIMENS :

England. Glos. : Westonbirt, 22 ft. Beds. : Woburn Abbey, 21 ft. Sussex : Warnham Court, 20 ft.

***Tsuga Mertensiana* Carrière.** (Syn. *T. Pattoniana* Sénéclauze; *T. Hookeriana* Carrière.) Mountain Hemlock. Western North America.

Tree attaining 100-150 ft. Distribution similar to *T. heterophylla*, but extending farther south to California;

it is generally an alpine species. Introduced into cultivation in England in 1854 by Wm. Murray. It is a slow-growing species; handsome specimens of pyramidal habit are now to be found in many of our older pineta.

NOTEWORTHY SPECIMENS :

England. Norfolk : Holkham, 52 ft. Lincoln : Brocklesby Park, 48 ft. Glos. : Westonbirt, 47 ft. \times 3 ft. 5 in. Oxford : Nuneham, about 40 ft. \times 3 ft. 8 in.

Scotland. Perth : Murthly, 72 ft. \times 6 ft. 5 in. and 68 ft. \times 5 ft. 9 in.

Tsuga Sieboldii Carrière. Southern Japanese Hemlock.

Tree attaining 100 ft. in Southern Japan. Introduced into Europe in 1850. In Britain generally seen as a bush or a small tree of dense habit.

NOTEWORTHY SPECIMENS :

England. Cornwall : Tregrehan, 25 ft. Kent : Little Hall, Canterbury, 24 ft. Sussex : Lydhurst, 60 ft. \times 11 ft. Hants. : Blackmoor, 20 ft.

Ireland. Co. Roscommon : Kilronan Castle, 22 ft.

CUNNINGHAMIA R. Brown

Evergreen trees. Leaves linear-lanceolate, flat, with a broad, decurrent base, twisted more or less into two opposite ranks; stomata forming a broad band on each side of the mid-rib on the under-surface and two narrow bands on the glossy upper surface. Flowers monœcious. Male flowers in short catkins forming a cluster at the end of the shoot. Female cones terminal, persistent, ovoid or rounded. Scales brown, stiff, toothed at the margin with the apex abruptly narrowed into a spine. Seeds 3 to 6 each scale, narrowly winged. Two species, E. Asia.

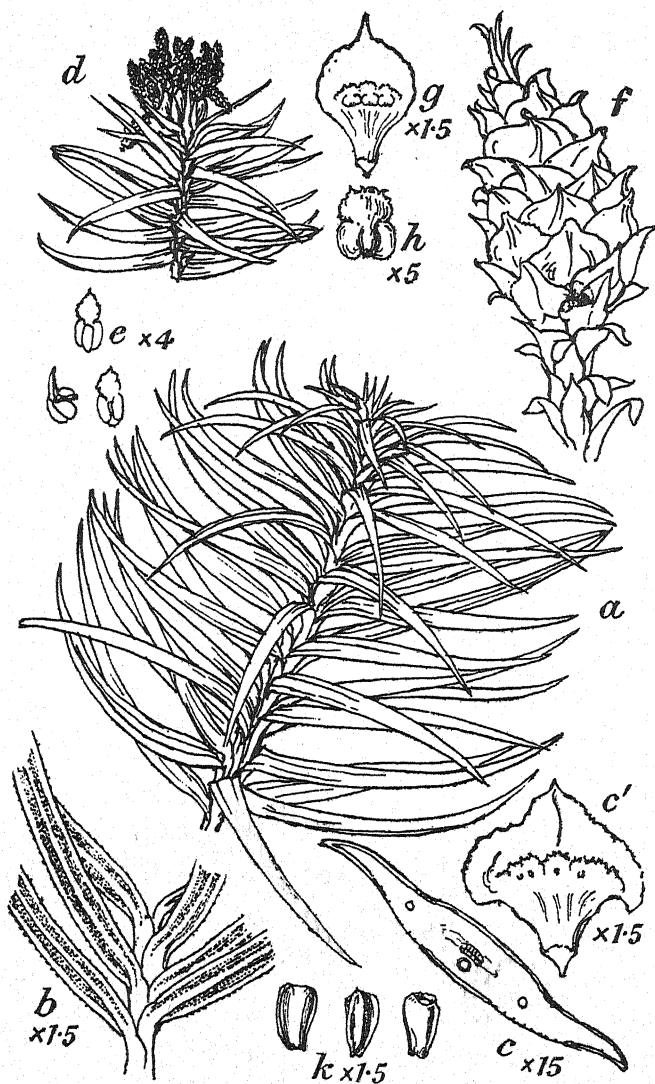


FIG. 29.—*CUNNINGHAMIA LANCEOLATA*.

a, branchlet; *b*, under-side of shoot, showing bands of stomata on leaves; *c*, section of leaf, showing three resin bands; *d*, cluster of male cones; *e*, stamens; *f*, female cone; *g*, cone-scale with three ovules attached below a toothed ridge; *h*, pendulous ovule; *i*, cone-scale, showing scars whence seeds have fallen; *k*, seeds with narrow wings.

Cunninghamia lanceolata Hooker. (Syn. *C. sinensis* R. Brown.) S. and W. China. (Fig. 29.)

Tree attaining 150 ft. in height and 18 ft. in girth. Introduced in 1804. It thrives in warm, sunny situations in the south and west of England and is a handsome and attractive conifer. It rarely ripens seed in this country.

NOTEWORTHY SPECIMENS :

England. Devon: Woodhouse, Uplyme, 60 ft. \times 6 ft.

Kent: Linton Park, 65 ft. \times 8 ft. Cornwall:

Coldrinnick, 55 ft. \times 6 ft.; Giendurgan, 55 ft. \times 6 ft.; Pencarrow, 50 ft. \times 7 ft.

Cunninghamia Konishii Hayata from Formosa, a more tender species, is distinguished by its smaller and narrower leaves and smaller cones. Young plants are in cultivation. Introduced in 1918.

CRYPTOMERIA. D. Don

Leaves awl-shaped, arranged spirally in five ranks. Cones globular, solitary, 12-18 mm. long, ripening the first year. Scales 20-30, stalked, with 3-6 spine-like processes at the apex; the bract combined with the scale for most of its length and ending in a recurved point. Seeds erect, 2-5 to each scale, very narrowly winged. One species in China and Japan.

Cryptomeria japonica D. Don. Japanese Cedar. Japan, China. (Fig. 30.)

Tree up to 150 ft. in height and 25 ft. in girth. Wood fragrant and durable. Introduced in 1842 and frequently cultivated. One of the most widely used timbers of Japan.

Var. *elegans* Masters. (Fig. 30.) Leaves spreading, often recurved, 1-2 cm. long, green in summer, reddish-

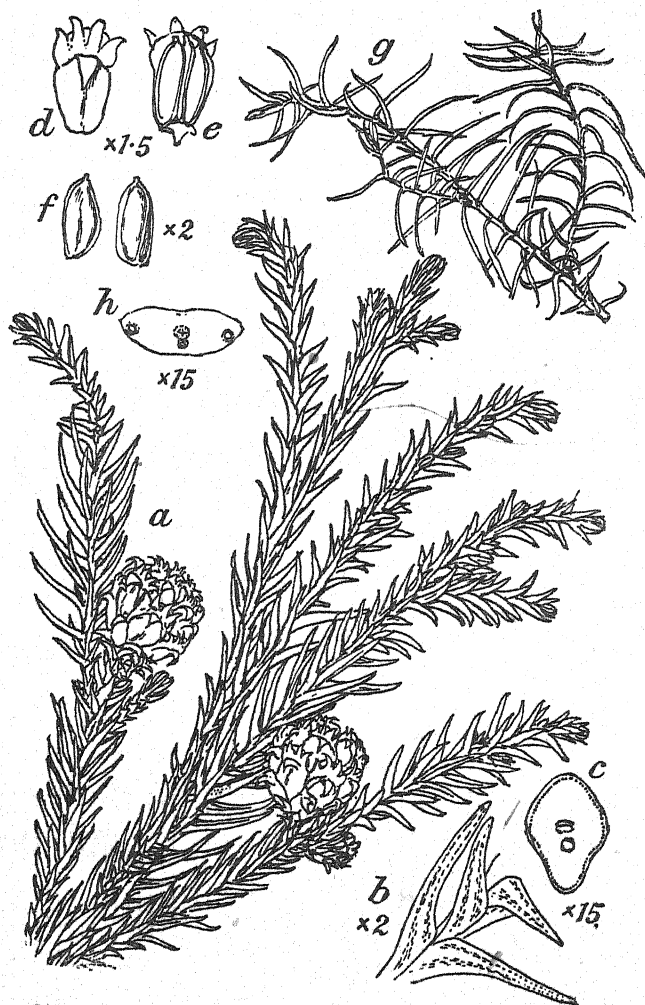


FIG. 30.—*CRYPTOMERIA JAPONICA* and var. *ELEGANS*.
 a, spray with three cones; b, leaves showing bands of stomata;
 c, section of leaf; d, cone-scale with its bract united below to the toothed
 seed-bearing scale; e, inner side of cone-scale, showing three seeds;
 f, seeds; g, spray of var. *elegans*; h, section of leaf.

bronze in autumn and winter. This variety represents the juvenile foliage of the species. It was introduced in 1861.

NOTEWORTHY SPECIMENS :

England. Shropshire : Leaton Knolls, 104 ft. Devon : Bicton, 95 ft. Hants. : Embley Park, 83 ft. Surrey : Bury Hill, 80 ft. Devon : Woodhouse, Uplyme, 88 ft. Hereford : Foxley, 85 ft. Hants. : Blackmoor, 83 ft.

Ireland. Co. Cork : Fota, 92 ft.

SEQUOIA Endlicher

Evergreen trees of pyramidal habit attaining gigantic proportions. Outer bark thick, spongy and fibrous. Leaves flat, in a two-ranked arrangement, or awl-shaped and spirally arranged. Flowers monœcious. Male cones clustered, terminal or axillary. Female cones globular, pendulous, with persistent woody scales wider and thicker above. Seeds 5-7 to each scale, narrowly winged. Two species. California.

Sequoia sempervirens Endlicher. Redwood. California and S. Oregon near the coast. (Fig. 31.)

A tree attaining 130-360 ft.¹ in height and 75 ft. in girth. Introduced as seed by Hartweg in 1846. The Redwood, which is one of the most ornamental conifers, thrives in many parts of Britain in sheltered situations ; it is rather susceptible to frost when young.

NOTEWORTHY SPECIMENS :

England. Hants. : Cuffnells, Lyndhurst, 150 ft. × 14 ft. ; Bassett Wood, 107 ft. × 15 ft. ; Rhinefield, New Forest, 106 ft. × 10 ft. 5 in. Devon : Wood-

¹ A Redwood standing near Dyorville Bridge in Humboldt County, California, is 364 ft. in height and 50 ft. in girth, and is commonly referred to as the world's tallest known standing tree.



FIG. 31.—*SEQUOIA SEMPERVIRENS*.

a, spray with female cone ; *b*, under-side of branchlet with male cone ; *c*, section of leaf, showing three resin canals ; *d*, male cone ; *e*, stamens ; *f*, female cone ; *g*, seeds.

house, Uplyme, 120 ft. \times 13 ft. Surrey: Bury Hill, 112 ft. \times 11 ft. 7 in. Hereford: Eastnor Castle, Ledbury, 106 ft. \times 16 ft. 6 in.

Scotland. Dumbarton: Rossdhu, 110 ft. \times 14 ft.

Sequoia Wellingtonia Seemann. (Syn. *S. gigantea* De-caisne.) **Wellingtonia**. California, on western slopes of the Sierra Nevada at 5,000–8,000 ft. (Fig. 32.)

A giant tree attaining 150–320 ft. in height and 90 ft. in girth above the buttressed base, at length clear of branches for more than half its height. Introduced in 1853. This magnificent conifer attains an age of over 3,000 years in its native forests. It has been widely planted in Britain as an ornamental tree and many fine specimens 100 ft. or more in height are to be seen in various parts of the country where the climate is moist.

NOTEWORTHY SPECIMENS:

England. Shropshire: Leaton Knolls, 143 ft. \times 11 ft.

Wilts.: Fonthill Abbey, 130 ft. \times 22 ft. Hants.:

Cuffnells, Lyndhurst, 125 ft. \times 18 ft. Surrey:

Bury Hill, 122 ft. \times 13 ft.; Albury Park, 117 ft.

\times 13 ft. Devon: Woodhouse, Uplyme, 120 ft.

\times 13 ft. Hereford: Foxley, 116 ft. \times 17 ft.

Glos.: Westonbirt, 124 ft. \times 20 ft. (1945).

Scotland. Perth: Murthly Castle, 120 ft. \times 13 ft.

ATHROTAXIS D. Don

Evergreen trees with spirally arranged awl-shaped or scale-like leaves. Flowers monocious, solitary at the apex of the branchlets. Staminate flowers catkin-like. Female cones globular; scales woody, spreading with a triangular spine-like process near the apex. Seeds 3–6 to each scale, winged. Three species, Tasmania.

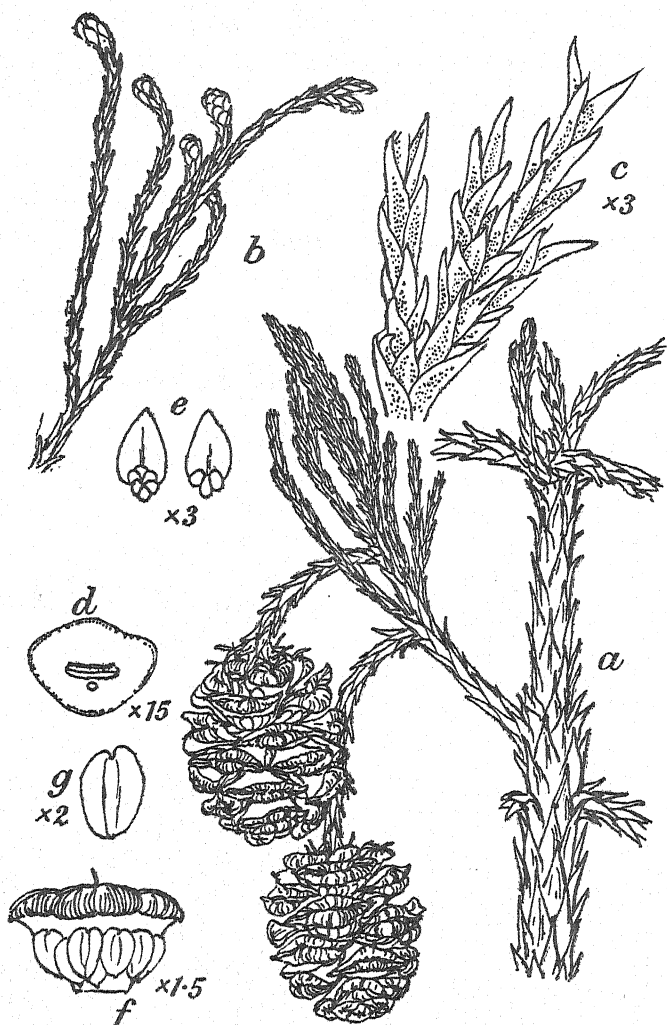


FIG. 32.—*SEQUOIA WELLINGTONIA*.

a, spray with two female cones ; *b*, spray with male cones ; *c*, branchlets ; *d*, section of leaf ; *e*, stamens ; *f*, cone-scale with seven seeds ; *g*, seed.

KEY TO ATHROTAXIS

- A. Leaves closely adpressed without stomata on ventral surface, scale-like obtuse at apex, about 3 mm. long, margin translucent
A. cupressoides
- AA. Leaves not adpressed, margin entire with two stomatic bands on the ventral surface.
 B. Leaves somewhat spreading, about 10 mm. long, incurved at the acute apex. Margin opaque *A. selaginoides*
- BB. Leaves slightly spreading, 5 mm. long, obtuse or acute; margin translucent *A. laxifolia*

Athrotaxis cupressoides D. Don. Tasmania.

Tree attaining 20-40 ft. in height and 3-5 ft. in girth. Introduced in 1857. It is occasionally met with in the British Isles where the climate is mild.

NOTEWORTHY SPECIMENS :

England. Cornwall : Tregrehan, 23 ft.

Ireland. Co. Wicklow : Powerscourt, 31 ft.; Kilmacurragh, 22 ft.

Athrotaxis laxifolia Hooker. Tasmania.

Tree attaining 25-30 ft. Introduced in 1857. Thrives in similar situations to the previous species.

NOTEWORTHY SPECIMENS :

England. Cornwall : Scorrier, 46 ft. ; Penjerrick, 40 ft. ; Menabilly, 35 ft. ; Trevarrick Hall, St. Austell, 40 ft. ; Tregrehan, St. Austell, 35 ft. and 24 ft.

Ireland. Co. Wicklow : Kilmacurragh, 39 ft.

Athrotaxis selaginoides D. Don. King William Pine. Tasmania. (Fig. 33.)

Tree reaching 100 ft. in height. Introduced about 1857. The best specimens are found in the south-west of England. It is rarer in cultivation than the other two species.

NOTEWORTHY SPECIMENS :

England. Cornwall : Tregrehan, 40 ft. and 32 ft. Sussex, Borde Hill, 21 ft. (1937).

Ireland. Co. Wicklow : Kilmacurragh, 44 ft. and 35 ft.

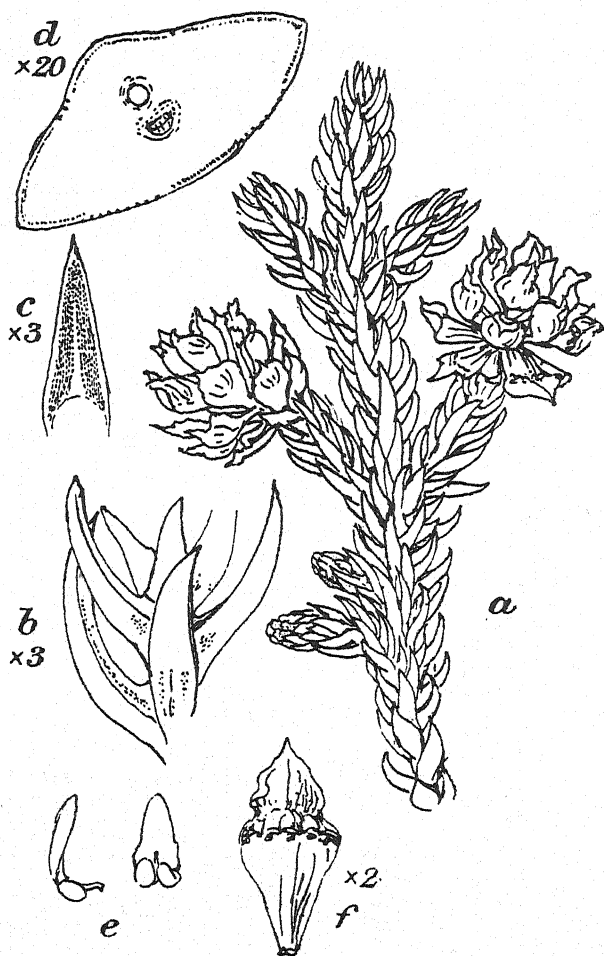


FIG. 33.—*ATHROTAXIS SELAGINOIDES*.

a, spray with two female cones, and two male cones; *b*, foliage showing stomata; *c*, inner side of leaf, showing stomatal buds; *d*, section of leaf; *e*, stamens; *f*, cone-scale with scars from which five seeds have fallen.

SCIADOPITYS Siebold and Zuccarini

Evergreen tree. Leaves of two kinds, (1) small and scale-like, (2) long leaf-like cladodes consisting each of two connate leaves grooved on each side arranged in whorls of 15-25. Flowers monœcious. Male catkins in dense terminal clusters. Female cones terminal, with thick woody roundish scales ripening in the second year. One species, Japan.

Sciadopitys verticillata Siebold and Zuccarini. Umbrella Pine. Japan. (Fig. 34.)

A tree attaining 70-120 ft. in height and 3-10 ft. in girth, of pyramidal habit when young, with short horizontal branches. Introduced in 1853. In cultivation it grows slowly, the best specimens being found in moist sheltered situations.

NOTEWORTHY SPECIMENS :

England and Wales. Denbigh: Bodnant, 41 ft. Cornwall: Scorrier, 27 ft. Worcester: Hewell Grange, 27 ft. Sussex: Leonardslee, 27 ft.

Scotland. Wigtown: Castle Kennedy, 28 ft.

TAXODIUM Richard

Deciduous or semi-evergreen trees with pale green, two-ranked foliage. Flowers monœcious. Male flowers in tassel-like clusters at the ends of the preceding year's shoots. Female cones globular, 25 mm. or more in diameter with thick, woody, peltate scales. Seeds angular, two to each scale. Two species; Eastern N. America and Mexico.

Taxodium distichum Richards. Deciduous Cypress.

S. United States in swamps and on banks of streams.

(Fig. 35.)

Tree, 100-150 ft. high. Introduced about 1640. It



FIG. 34.—*SCIADOPITYS VERTICILLATA*.

a, shoot with whorls of scale-leaves, and of needle-leaves united in pairs; *b*, branchlet with male cones; *c*, female cones; *d*, section of leaf, showing eight resin canals and an ideoblast; *e*, cone-scale with ovules; *f*, seed.



FIG. 35.—*TAXODIUM DISTICHUM*.

a, spray; *b*, foliage; *c*, section of leaf; *d*, spray with male flowers; *e*, male flower; *f*, stamen with three pollen sacs; *g*, female cone; *h*, two seeds, dorsal view; *i*, seed; *k*, transverse section of seed; *l*, shoot of var. *pendulum*.

thrives in moist situations throughout the midland and southern counties, but is much less planted than formerly. In summer the foliage is of a delicate green colour, which changes in autumn to a rich brown or orange. In wet and swampy places, woody cylindrical or oval protuberances known as "cypress-knees," sometimes several feet high, arise from the roots and have probably respiratory functions.

The var. *imbricarium* Croom, regarded by some botanists as a species (*T. ascendens* Brongniart), is occasionally met with in cultivation. It is a smaller tree than the typical form with the leaves adpressed to the branchlets.

NOTEWORTHY SPECIMENS :

England. Middlesex : Syon House, 95 ft. \times 11 ft. 8 in. and 90 ft. \times 13 ft. Isle of Wight : Buckland Grange, 88 ft. Herts. : Wormley Bury, 86 ft. \times 9 ft. Surrey : Knaphill Nursery, Woking, 85 ft. \times 9 ft. Cornwall : Glendurgan, 80 ft. \times 8 ft.

ARAUCARIA Jussieu

Evergreen trees with regularly whorled branches. Leaves spirally arranged, flat, subulate or scale-like and stiff. Flowers usually dioecious. Male catkins cylindrical, solitary or in clusters, consisting of numerous spirally arranged stamens. Cones ripening in two or three years, globular or ovoid with woody, closely overlapping scales, each with a solitary wingless seed which is adnate to the scale. About twelve species in S. America, Australia and the Pacific Islands to New Guinea.

KEY TO ARAUCARIA

- A. Leaves flat, lanceolate 2.5-5 cm. *A. araucana* (Syn. *A. imbricata*)
 AA. Leaves awl-shaped, incurved, 1-2 cm. *A. excelsa*

Araucaria araucana K. Koch. (Syn. *A. imbricata* Pavon.)
Monkey Puzzle. Chile Pine. Up to 6,000 ft. Chile
to N. Patagonia.

A tree up to 150 ft. in height and 15 ft. in girth, with stiff foliage arranged in distinct spirals. Introduced in 1795 by Archibald Menzies, who brought home living plants which he had raised on board ship. Not commonly cultivated until after 1844.

NOTEWORTHY SPECIMENS :

England and Wales. Devon : Bicton, 71 ft. \times 10 ft. 8 in.
Cornwall : Scorrier, 69 ft. \times 7 ft. 5 in. Wilts. : Bo-
wood, 68 ft. \times 8 ft. Glos. : Westonbirt, 74 ft. \times 6 ft.
(1945). Caernarvon : Penrhyn Castle, 68 ft. \times 7 ft.
3 in.

Scotland. Ayr : Blairquhan, 69 ft.

Ireland. Co. Waterford : Curraghmore, 76 ft. \times 7 ft.

Araucaria excelsa R. Brown. Norfolk Island Pine.
Pacific.

A tree 150-200 ft. high. Introduced in 1793. Is
usually seen in Britain as a pot plant.

CUPRESSACEÆ

FITZROYA Hooker fil.

Evergreen tree or shrub with leaves in whorls of three. Flowers dioecious. Male flowers oblong, solitary, terminal. Female cones, solitary, terminal with 2-3 rows of whorled scales, of which only the upper are fertile; apex of the cone terminating in one or more slender, barren scales, each tipped with a resin gland. Seeds 2-3, winged. One species, Chile.

Fitzroya cupressoides Johnston. (Syn. *F. patagonica* Hooker fil.) Chile and N. Patagonia. (Fig. 36.)

Tree attaining 80-100 ft. in height and 10-16 ft. in girth. Introduced in 1849 by Wm. Lobb. Usually seen as a shrub or small tree in this country, the best examples being met with in the western counties where the climate is mild and moist.

NOTEWORTHY SPECIMENS :

England. Cornwall: Penjerrick, 40 ft. \times 8 ft. 6 in.; Heligan, 35 ft. Devon: Woodhouse, Uplyme, 35 ft.

Scotland. Argyll: Stonefield, 43 ft. \times 6 ft. 6 in. Renfrew: Ardgowan, 35 ft.

Ireland. Co. Cork, Fota, 37 ft. \times 4 ft.

CUPRESSUS Linnæus

Branchlet systems pinnately divided. Adult leaves scale-like, adpressed, in opposite pairs. Flowers monoecious. Male flowers ovoid to oblong. Female cones sub-

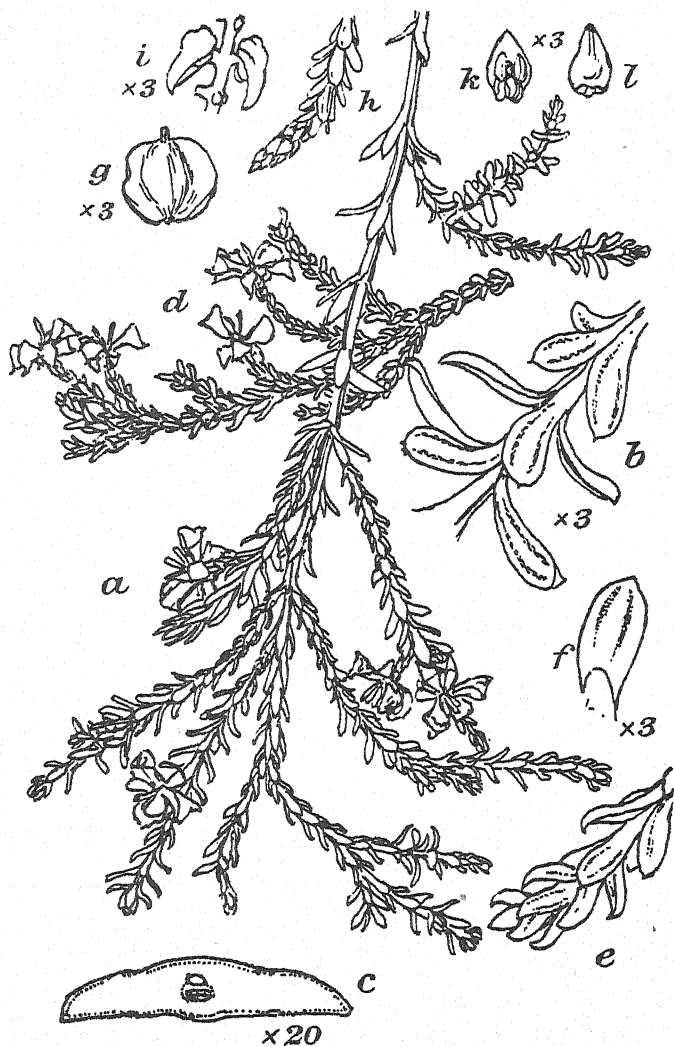


FIG. 36.—*FITZROYA CUPRESSOIDES*.

a, spray bearing loose foliage and many expanded cones; *b*, leaves showing two bands of stomata on both upper and lower surfaces; *c*, section of leaf, showing central resin canal; *d*, spray bearing closer foliage; *e*, branchlet with close foliage; *f*, inner surface of leaf showing bands of stomata; *g*, seed; *h*, male cone with stamens in whorls of three; *i*, two stamens attached to the axis, and stalks of other stamens; *k*, inner aspect of stamen bearing five anthers; *l*, outer aspect of stamen.

globose, woody, with 6-12 peltate scales, usually with a central prominent boss or spine. Seeds one to many on each scale, narrowly winged. About 18 species, widely distributed in the warm temperate regions of the northern hemisphere.

KEY TO CUPRESSUS

- A. Branchlet systems flattened, frond like, arranged in horizontal planes.
 - B. Seeds more than 5 on each scale. Cones 8-16 mm. diam.
 - C. Branchlets quadrangular. Leaves obtuse or sub-acute, adpressed. Cone scales with the central spine short and scarcely reflexed. *C. torulosa*
 - CC. Branchlets compressed. Leaves acute or acuminate, slightly spreading at apex. Cone scales with a prominent reflexed spine. *C. lusitanica* var. *Benthami*
- BB. Seeds 1-5 on each scale, cones up to about 1 cm. diam.
 - C. Foliage usually with white or glaucous markings beneath.
 - D. Leaves obtuse, with minute sunk glands. Foliage usually with white Y-shaped markings beneath. Cones 8-12 mm. diam. *C. obtusa*
 - DD. Leaves acute, obscurely glandular. Cones 6-8 mm. diam. *C. pisifera*
 - DDD. Leaves acute, with distinct glands visible as translucent spots when the spray is held against the light. Foliage usually with ill-defined white markings beneath. Staminate flowers, pink. *C. Lawsoniana*
 - CC. Foliage without white markings on lower surface.
 - D. Cones up to 10 mm. diam. ripening the second year.
 - E. Foliage dull green, without glands, rank scented. Facial leaves with a median ridge. Cones with a plum-coloured tinge, ripening in the second year, with a prominent central spine to each scale. Staminate flowers, yellow. *C. nootkatensis*
 - EE. Foliage grey-green, pendulous, not scented. Cones greenish-brown with a minute central boss to each scale. *C. funebris*
 - DD. Cones up to about 6 mm. diam., ripening the first year.
 - E. Branchlet systems fan-shaped, erect. Foliage bluish or light green. Leaves acute, with a prominent gland on the back. Cones globose. *C. thyoides*
 - EE. Branchlet systems tapering upwards, drooping towards the tips. Foliage green, often tinged with bronze. Cones shortly ellipsoid. *C. formosensis*

- AA. Branchlet systems arising at different planes.
 - B. Leaves with a conspicuous resin gland on back.
 - C. Branchlets compressed. Foliage bright green. Leaves obtuse *C. Macnabiana*
 - CC. Branchlets four-sided. Foliage glaucous. Leaves acute *C. arizonica* var. *bonita*
 - BB. Leaves not conspicuously glandular.
 - C. Cones 2-3 cm.
 - D. Branchlets tapering at the tips. Leaves 1 mm. long, closely adpressed. Cones brown or grey, slightly glossy. Seeds without resin tubercles *C. sempervirens*
 - DD. Branchlets not tapering at the tips. Leaves 2 mm. long, adpressed. Cones shining reddish-brown. Seeds with resin tubercles *C. macrocarpa*
 - CC. Cones 1-2 cm.
 - D. Branchlets spreading at wide angles. Foliage fragrant. Leaves 1-2 mm. long. Cones shining brown *C. Gooveniana*
 - DD. Branchlets spreading at acute angles. Foliage not fragrant. Leaves 2 mm. long, acuminate. Cones glaucous when young *C. lusitanica*

Cupressus arizonica Greene. Mountains of Arizona and N. Mexico.

Tree attaining 70 ft. in height and 12 ft. in girth. Introduced in 1882. The plant grown under this name in England is apparently var. *bonita* Lemmon (*C. glabra* Sudworth), which is distinguished from the type by having white exudations on the leaves. It is an attractive tree with glaucous foliage.

NOTEWORTHY SPECIMENS :

England. Sussex: Borde Hill, three trees between 20 ft. and 25 ft.

Ireland. Co. Meath: Headfort, 27 ft. × 6 ft.

Cupressus formosensis Henry. (Syn. *Chamaecyparis formosensis* Matsumura.) Mount Morrison, Formosa, at 7,000-14,000 ft.

Tree attaining 195 ft. in height and 72 ft. in girth. Introduced in 1910 by Vice-Admiral Sir Lewis Clinton-Baker. An ornamental but not very hardy tree.

NOTEWORTHY SPECIMENS :

England. Surrey : Leonardslee, 19 ft. Sussex : Bordon Hill, 15 ft. Herts. : Bayfordbury, 14 ft.

Cupressus funebris Endlicher. Chinese Weeping Cypress. Central China, usually below 3,000 ft.

Tree attaining 70 ft. and 6 ft. in girth. Introduced about 1848. It is an elegant cypress with drooping branchlets but thrives only in a mild climate.

NOTEWORTHY SPECIMENS :

England. Kent : Linton Park, 40 ft. \times 9 ft. 6 in. (at base). Cornwall : Penjerrick, 30 ft.

Ireland. Co. Wicklow : Powerscourt, 35 ft.

Cupressus Goveniana Gordon. Coastal mountains of California.

Tree attaining 50 ft. in cultivation, but usually much smaller in a wild state. Introduced in 1848 by Hartweg. Somewhat resembling *C. macrocarpa* in habit, it is distinguished by its more fragrant foliage and smaller cones. The best trees occur in the milder climate of south-west England.

NOTEWORTHY SPECIMENS :

England. Cornwall : Boconnoc, two trees of 70 ft. and 57 ft. Devon : Woodhouse, Uplyme, 45 ft.

Cupressus Lawsoniana Murray. (Syn. *Chamaecyparis Lawsoniana* Parlatores.) Lawson Cypress. S.W. Oregon and N.W. California. (Fig. 37.)

Pyramidal tree attaining 200 ft. in height and 20 ft. or more in girth. Introduced in 1854 when Murray sent seeds to Messrs. Lawson of Edinburgh. It is one of the hardiest and most popular conifers in our gardens. Under cultivation it is extremely variable, nearly one hundred varieties having been described.



FIG. 37.—*CUPRESSUS LAWSONIANA*.

a, spray with expanded female cones and many branchlets whence male cones have fallen; *b*, branchlets; *c*, young female flowers; *d*, young cone-scale with four ovules; *e*, seed; *f*, juvenile leaves.

NOTEWORTHY SPECIMENS :

England and Wales. Cornwall : Penjerrick, 110 ft. \times 12 ft. 6 in. Gos. : Westonbirt, 82 ft. \times 8 ft. 5 in. Devon : Woodhouse, Uplyme, 90 ft. Hereford : Foxley, 90 ft. Hants. : Rhinefield, 80 ft. 8 in. Caernarvon : Penrhyn, 98 ft. \times 7 ft. 5 in.

Scotland. Lanark : Dolphinton, 87 ft. Dumfries : Duncraig Castle, 81 ft.

Cupressus lusitanica Miller. Mexican Cypress. Mexico and Guatemala from 4,000 to 10,000 ft.

Tree attaining 100 ft. in height and 12 ft. in girth. Introduced about 1682. The var. *Benthami* Carrière has regularly flattened branchlet systems. It was introduced in 1838. Thrives best in the south-west of England.

NOTEWORTHY SPECIMEN :

England. Gos. : Westonbirt, 70 ft.

Cupressus Macnabiana Murray. S. Oregon and California.

Tree attaining 40 ft. in height and 4 ft. in girth. Introduced in 1854, old trees are seldom seen in this country. For a time it seemed to have almost gone out of cultivation and is still rarely planted. The resinous exudations of the foliage are characteristic.

NOTEWORTHY SPECIMENS :

England. Sussex : Borde Hill, 10 ft. Gos. : Highnam Court, 30 ft. Herts. : Buckenden Grange, 25 ft. Cambridge : Cambridge Botanic Garden, 15 ft. Devon : Bicton, 15 ft.

Ireland. Co. Meath : Headfort, 8 ft.

Cupressus macrocarpa Hartweg. Monterey Cypress. Monterey Peninsula, California. (Fig. 38.)

Tree attaining 70 ft. in height in California but often much taller in cultivation. Introduced before 1838.

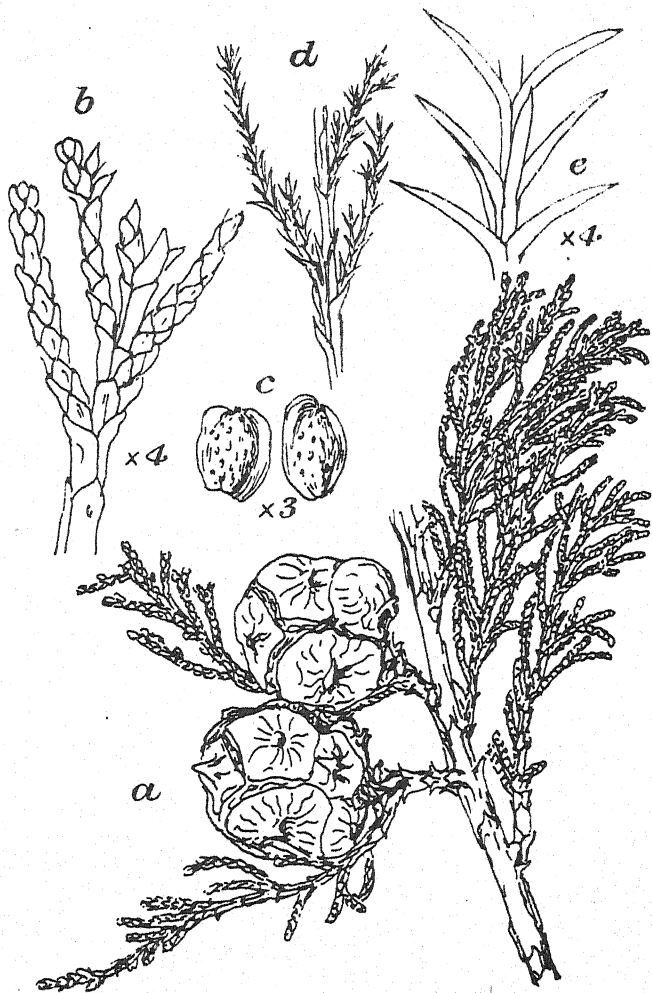


FIG. 38.—*CUPRESSUS MACROCARPA*.

a, spray with two cones; *b*, branchlets; *c*, seeds marked with resin glands; *d*, *e*, juvenile foliage.

Common in the south and south-west counties near the sea, where it is valued as a windbreak and on account of its rich green foliage. It is also successfully grown in Africa, Australia and New Zealand.

NOTEWORTHY SPECIMENS :

England. Devon : Woodhouse, Uplyme, 107 ft. Cornwall : Carclew, 100 ft. ; Scorrier, 95 ft. Devon : Bickton, 88 ft. Wilts. : Wilton Park, 87 ft. Bedford : Woburn Abbey, 99 ft. Hants. : Embley Park, 86 ft.

Ireland. Co. Down : Castlewellsan, 90 ft.

NOTE.—× *Cupressus Leylandii* Jackson and Dallimore (*C. macrocarpa* × *nootkatensis*). Hybrid Cypress. Raised at Haggerston Castle, Northumberland, in 1888, and Leighton Hall, Welshpool, in 1911. Closely resembles *C. nootkatensis* in foliage but has cones up to 2 cm. in diam. and only about five seeds to each scale. (*Kew Bulletin*, 1926, p. 115.) Is proving itself to be one of the hardiest and most vigorous conifers in cultivation. It is now (1945) about 39 ft. high in the Edinburgh Botanic Gardens.

***Cupressus nootkatensis* Lambert.** (Syn. *Chamæcyparis nootkatensis* Spach.) Yellow Cypress. Pacific Coast Region of N.W. America. (Fig. 39.)

A pyramidal tree attaining 120 ft. in height and 18 ft. in girth. Introduced about 1853. It is frequently cultivated in Britain as an ornamental tree, and when well grown is a very handsome cypress. The scent of the foliage is strong and unpleasant, somewhat resembling that of the Savin Juniper.

NOTEWORTHY SPECIMENS :

England. Worcester : Hewell Grange, 93 ft. × 6 ft. Glos. : Westonbirt, 79 ft. × 10 ft. 5 in. Devon :

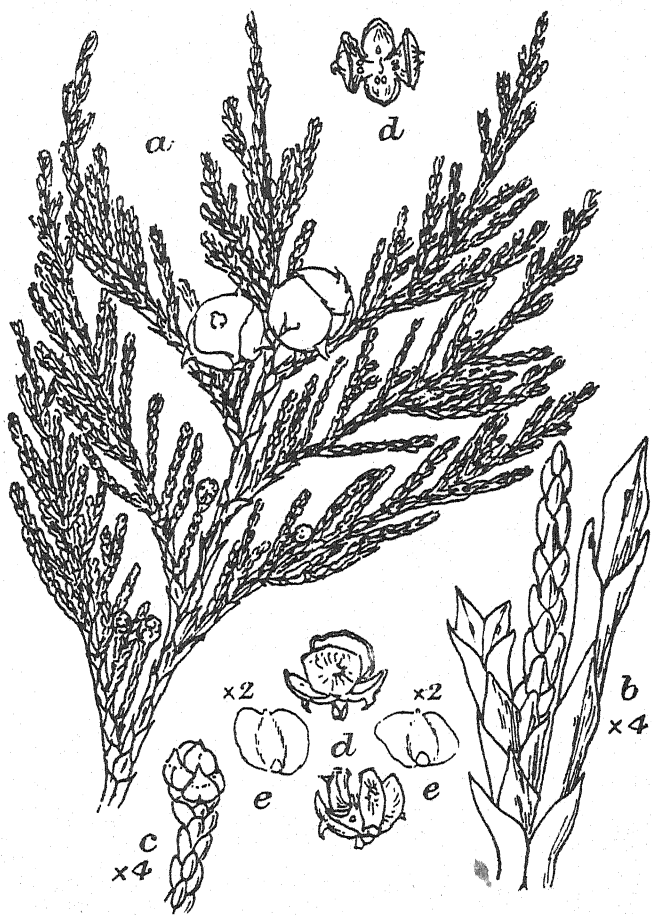


FIG. 39.—*CUPRESSUS NOOTKATENSIS*.

a, spray with two cones ; *b*, branchlet ; *c*, male cone ; *d*, expanded female cones in various positions ; *e*, seeds.

Bicton, 70 ft. Surrey : Pain's Hill, 68 ft. Glos. : Tortworth, 63 ft.

Scotland. Argyll : Poltalloch, 71 ft. Dumfries : Langholm, 64 ft.

Cupressus obtusa Koch. (Syn. *Chamæcyparis obtusa* Siebold and Zuccarini.) Hinoki Cypress. Central and S. Japan at 2,000–5,000 ft. (Fig. 40.)

Tree attaining 120 ft. in height and 12 ft. in girth. Introduced in 1861. Often seen in gardens where numerous varieties are cultivated. The timber is much valued in its native land.

NOTEWORTHY SPECIMENS :

England. Glos. : Westonbirt, 50 ft.

Scotland. Argyll : Stonefield, 40 ft.

Ireland. Co. Roscommon : Kilonan Castle, 51 ft.

Cupressus pisifera Koch. (Syn. *Chamæcyparis pisifera* Siebold and Zuccarini.) Sawara Cypress. Central and S. Japan at 2,000–5,000 ft.

Tree attaining 120 ft. in height and 12 ft. in girth. Introduced in 1861. Very common in cultivation, especially in its juvenile forms ; of these the best known are var. *plumosa* Masters (*Retinispora plumosa* Veitch) with soft awl-shaped foliage and var. *squarrosa* with feathery habit and spreading foliage. The latter was introduced in 1848.

NOTEWORTHY SPECIMENS :

England. Kent : Linton Park, 59 ft. and 47 ft. Cornwall : Scorrier, 45 ft. ; Heligan, 40 ft. Glos. : Westonbirt, three of different forms from 41 ft. to 43 ft. Northumberland : Falloden, 41 ft.

Var. *plumosa aurea* :

England. Glos. : Westonbirt, 41 ft.

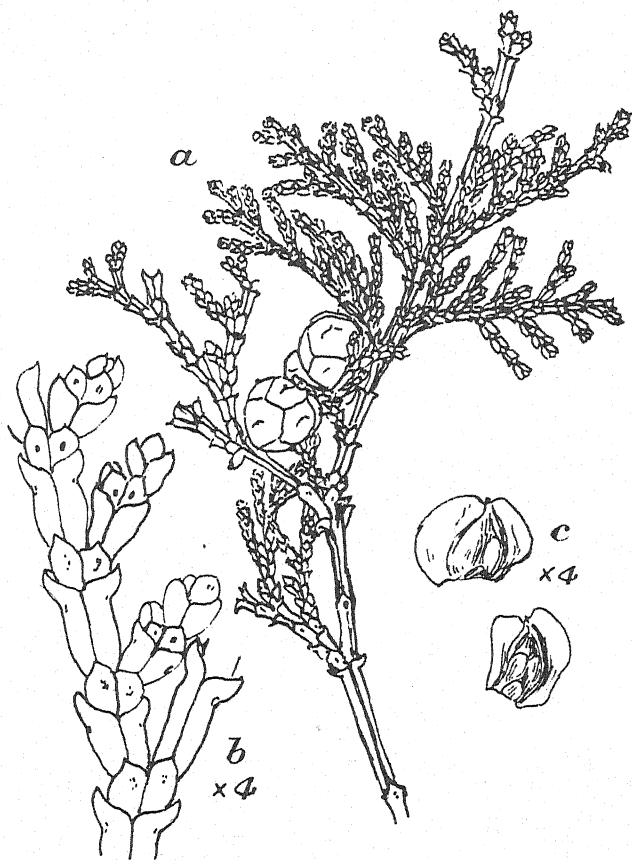


FIG. 40.—*CUPRESSUS OBTUSA*.

a, spray with two cones; *b*, branchlets; *c*, seeds.

Var. *squarrosa* :

England and Wales. Glos. : Westonbirt, 42 ft.
Denbigh : Bodnant, 47 ft. and 35 ft.

Cupressus sempervirens Linnæus. Mediterranean Cypress. Eastern Mediterranean to mountains of N. Persia.

Tree attaining 150 ft. in height and 10 ft. in girth. Cultivated in this country for several centuries, it succeeds best in the milder parts of the British Isles. The pyramidal form is a characteristic feature of gardens and cemeteries in S. Europe, where it is often planted as a wind-break. It is the classical cypress of the ancients. The fragrant wood is used for making clothes-chests in Italy. Closely allied to *C. macrocarpa*, from which it may be distinguished by its more slender branchlets tapering towards the tip and seeds being without resin-tubercles. Another nearly allied species is *C. Duclouxiana* Hickel, a native of Yunnan and introduced about 1900. It is distinguished by its more slender glaucous branchlets. It appears to be somewhat tender in cultivation.

NOTEWORTHY SPECIMENS :

England and Wales. Hereford : Foxley, 88 ft. × 10 ft. 6 in. Hants. : Exbury, 66 ft. 6 in. × 8 ft.
Wilts. : Wardour Castle, 62 ft. × 9 ft. 4 in. ;
Caernarvon : Penrhyn Castle, 66 ft. × 3 ft.
Ireland. Co. Kerry : Dereen, 70 ft. × 16 ft.

Cupressus thyoides Linnæus. (Syn. *Chamæcyparis thyoides*.) White Cypress. Atlantic states of N. America from Maine to Florida west to Mississippi.

Tree attaining 90 ft. in height and 12 ft. in girth. Introduced in 1736 by Peter Collinson. It has little value as an ornamental tree and is not often cultivated.

NOTEWORTHY SPECIMENS :

England. Wilts. : Stourhead, 19 ft. Surrey : Knap-hill Nursery, 18 ft.

Cupressus torulosa D. Don. Himalayan Cypress. West Himalayas at 5,000-9,000 ft. altitude and W. Szechuan, China.

Tree attaining 150 ft. in height and 37 ft. in girth. Introduced into Europe in 1824 by Wallich. A beautiful, but not very hardy cypress, distinguished chiefly by its slender curved pendulous branchlets.

NOTEWORTHY SPECIMENS :

England. Devon : Bicton, 74 ft. Worcester : Hewell Grange, 64 ft.

Ireland. Co. Wicklow : Powerscourt, 62 ft.

LIBOCEDRUS Endlicher

Branchlet systems flattened. Leaves scale-like in opposite pairs. Flowers monœcious. Male flowers terminal, oblong. Female cones oblong with 2-6 valvate scales of which the middle pair alone is fertile. Seed with two unequal wings. Nine species in N. and S. America, New Zealand, New Caledonia, New Guinea, Formosa and S.W. China.

KEY TO LIBOCEDRUS

Median and lateral leaves equal in length	:	:	:	<i>L. decurrens</i>
Lateral leaves longer than the median	:	:	:	<i>L. chilensis</i>

Libocedrus chilensis Endlicher. Chile. (Fig. 41.)

Tree up to 50 ft. in height. Introduced in 1847. It is rare in cultivation, being slow in growth, apparently succeeding best in the milder parts of the country.

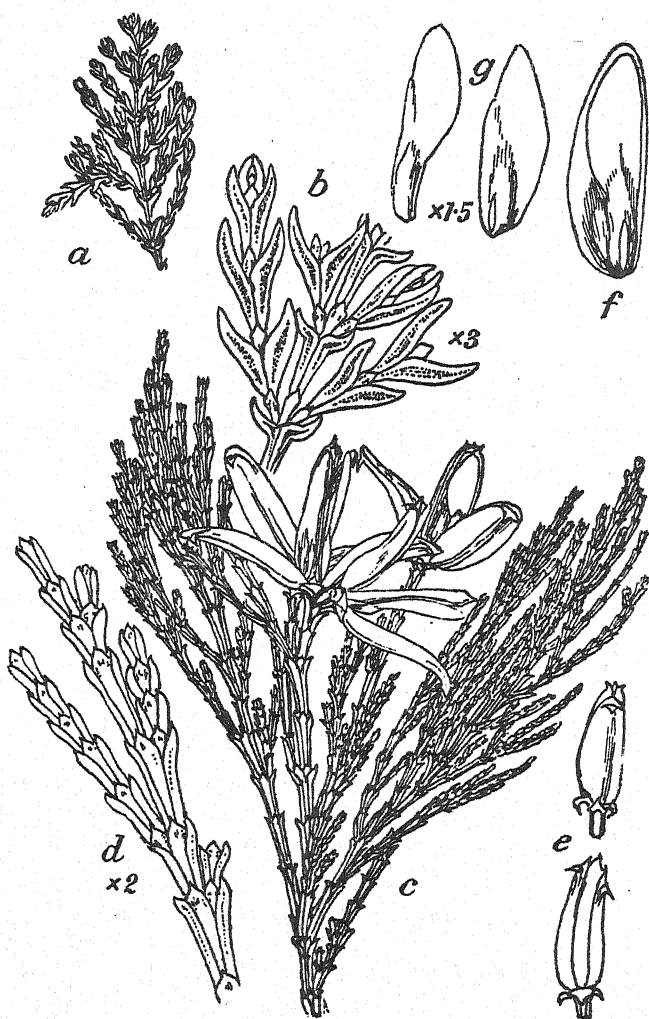


FIG. 41.—*LIBOCEDRUS CHILENSIS* and *L. DECURRENS*.
Libocedrus chilensis—a, spray; b, branchlets. *L. decurrens*—c, spray
 with two expanded cones; d, branchlets; e, cones; f, cone-scale with
 seed; g, seeds.

NOTEWORTHY SPECIMENS :

England. Devon : Whiteway, 50 ft. \times 6 ft. Beds. :
Woburn Abbey, 32 ft.

Ireland. Co. Wicklow : Powerscourt, 41 ft. 6 in. \times 5 ft.

Libocedrus decurrens Torrey. Incense Cedar. Oregon
along the western slopes of the Cascade Sierra Nevada
ranges to Lower California from 3,000 to 8,500 ft.
(Fig. 41.)

Tree up to 200 ft. in height and 18 ft. in girth. Introduced in 1853. Frequent in cultivation. Its columnar habit is very noticeable among other conifers, resembling *Cupressus Lawsoniana* var. *erecta viridis* in outline. The sprays of foliage have a characteristic jointed appearance.

NOTEWORTHY SPECIMENS :

England. Sussex : Leonardslee, 82 ft. \times 8 ft. 6 in.
Berks. : Frogmore, 83 ft. \times 13 ft. 2 in. Devon :
Bicton, 81 ft. \times 10 ft. Specimens between 70 and
80 ft. in height may be seen at Orton Hall, Peter-
borough, Northants ; Stourhead, Wilton Park, and
Bowood, Wilts. ; Holkham, Norfolk ; Westonbirt,
Glos. ; Nuneham Park, Oxford ; Linton Park,
Kent ; Brocklesby Park, Lincoln ; and Rossie Priory,
Perth, Scotland.

THUJA Linnaeus

Evergreen trees of pyramidal shape with short branches. Branchlet systems flattened. Leaves decussate, scale-like. Flowers monœcious. Male catkins ovoid, with 3-6 pairs of stamens. Female cones ovoid or oblong, composed of 8-12 scales which are thickened upwards, the 2 or 3 middle pairs fertile. Seeds winged or wingless. Six species in temperate N. America and N.E. Asia.

KEY TO THUJA

- A. Branchlet systems disposed in vertical planes. Foliage green on both sides. Cone scales with recurved spines. Seeds wingless
T. orientalis
- AA. Branchlet systems horizontal. Cone scales without recurved spines.
 - B. Foliage conspicuously glandular, yellowish or bluish green beneath
T. occidentalis
 - BB. Foliage inconspicuously glandular.
 - C. Branchlet systems stout; with main axes flattened; ultimate divisions 5 mm. or more diam. Foliage with conspicuous white markings beneath
T. dolabrata
 - CC. Branchlet systems flattened; ultimate divisions 2-3 mm. diam.
 - D. Foliage aromatic; under surface marked with white streaks
T. plicata
 - DD. Foliage not aromatic. (Syn. *T. Lobbi*)
 - E. Under surface of foliage marked with white streaks in the lower half
T. Standishii (Syn. *T. japonica*)
 - EE. Under surface of foliage glaucous beneath
T. koraiensis

Thuja dolabrata Linnæus. (Syn. *Thujopsis dolabrata* Siebold and Zuccarini.) Japan.

Tree attaining 40-100 ft. in height, occasionally of scrubby habit. Introduced into cultivation in 1858 by Thos. Lobb. Distinguished from the other *Thujas* by its larger leaves, which are conspicuously white beneath. In this country it succeeds best in the south and south-west counties, where the climate is mild and moist, and there it becomes a handsome conifer.

NOTEWORTHY SPECIMENS:

England. Cornwall: Penjerrick, 50 ft.; Scorrier, 42 ft.; Trevarrick Hall, 40 ft.

Ireland. Co. Roscommon: Kilronian Castle, 48 ft.; Rockingham, 42 ft.

Thuja koraiensis Nakai. Korea.

A low spreading shrub or a small tree of pyramidal habit. Introduced in 1918. Differing from the allied Japanese *T. Standishii* by being shrubby in habit and by

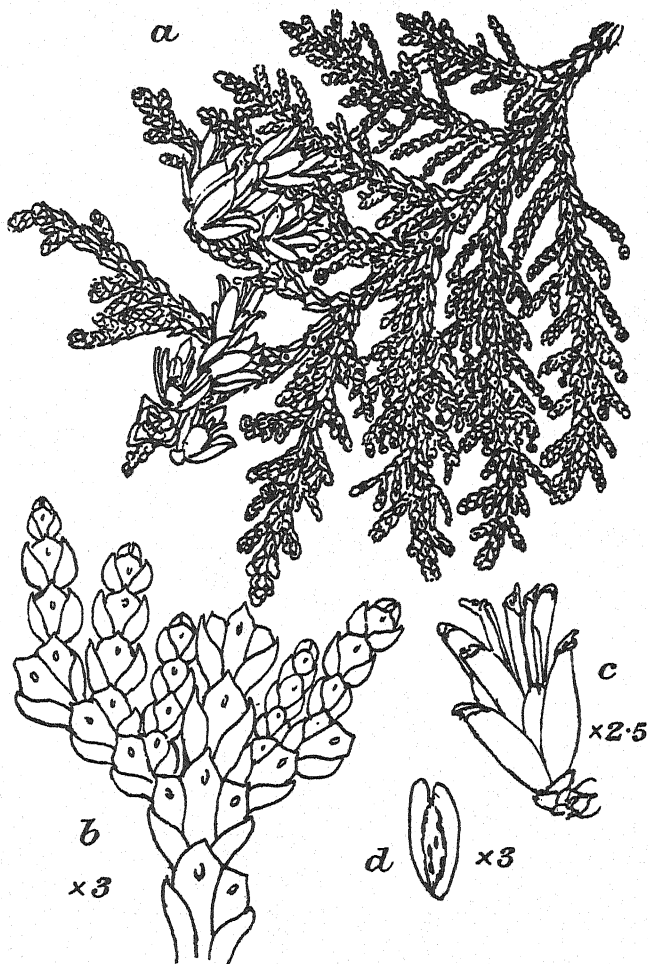


FIG. 42.—*THUJA OCCIDENTALIS*.

a, spray with male and female cones; *b*, branchlets, under-surface; *c*, expanded cone; *d*, seed.

its bright green foliage which is conspicuously glaucous beneath. It is quite hardy in cultivation.

Thuja occidentalis Linnæus. Eastern N. America. (Fig. 42.)

Tree attaining 50–60 ft. in height and 9 ft. or more in girth. Introduced about 1596. It is frequently met with in gardens where numerous named varieties are cultivated. It differs from *T. plicata* by its smaller growth and the leaves which are pale green, not streaked with white beneath and by the more prominent resin glands.

Thuja orientalis Linnæus. Chinese Arbor-vitæ. N. and W. China. (Fig. 43.)

A bush or small tree attaining 30–40 ft. in height. Introduced early in the eighteenth century. It is easily known by the vertical arrangement of its branchlets and the strongly hooked tips of the cone scales. Very common in cultivation. A large number of forms have been given varietal names.

Thuja plicata D. Don. (Syn. *T. Lobbii* Hort.) Giant Arbor-vitæ. Western N. America from Alaska to California and Montana. (Fig. 44.)

Tree attaining 150–200 ft. in height and 12–20 ft. in girth, often with a broad and buttressed trunk. Introduced in 1853 by Lobb. Widely grown in English gardens and plantations, where it becomes a handsome tree of pyramidal habit furnished with branches to the ground. In its native country it furnishes an important timber under the name of "Red Cedar."

NOTEWORTHY SPECIMENS:

England. Cornwall: Scorrier, 120 ft. \times 7 ft.; Pen-jerrick, 110 ft. \times 11 ft. Hereford: Foxley, 109 ft. \times 9 ft. Devon: Bicton, 107 ft. \times 14 ft. Several others of over 100 ft. high are recorded.

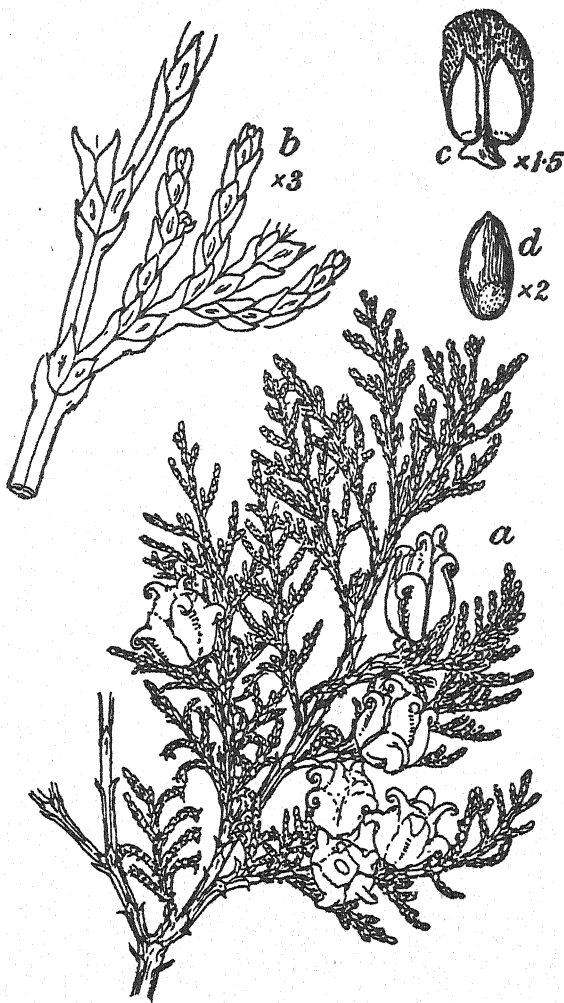


FIG. 43.—*THUJA ORIENTALIS*.

a, spray with cones ; *b*, branchlets ; *c*, cone-scale with two seeds ;
d, seed.

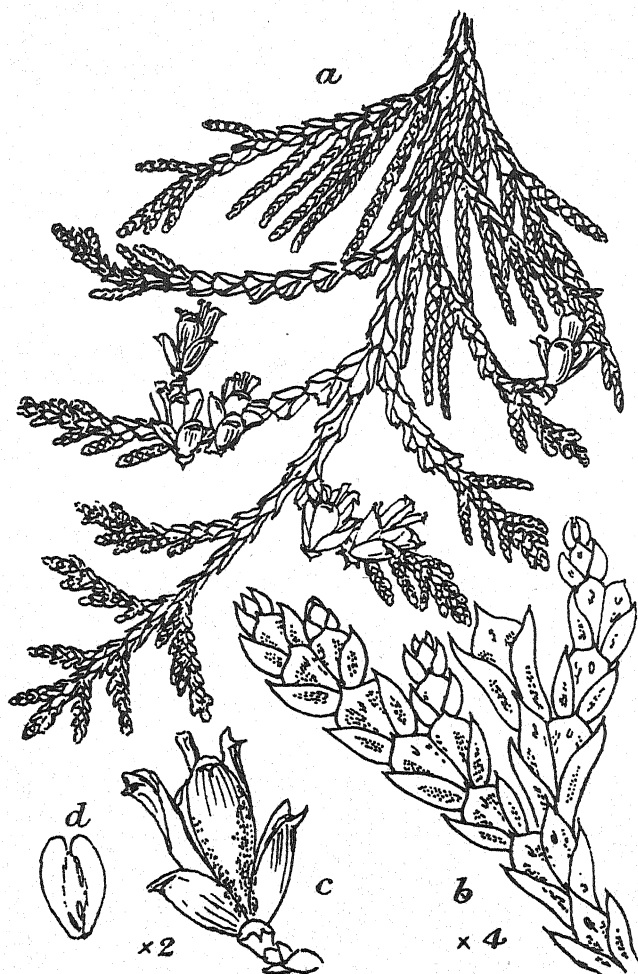


FIG. 44.—*THUJA PLICATA*.
a, spray with female cones, and short broad branchlets from which male cones have fallen; *b*, branchlet, showing bands of stomata on under-surface of leaves; *c*, expanded cone; *d*, seed.

Thuja Standishii Carrière. (Syn. *T. japonica* Maximowicz.) Mountains of Central Japan.

A small tree attaining 30-40 ft. in height and 7 ft. in girth. Introduced in 1860 by Fortune. Differs from *T. plicata* in its broader crown and paler foliage without glands. It is less commonly cultivated than the other species of *Arbor-vitæ*.

NOTEWORTHY SPECIMENS :

England. Kent : Linton Park, 49 ft. Glos. : Westobirt, 41 ft. Cornwall : Pencarrow, 35 ft.

Scotland. Midlothian : Oxenfoord, 70 ft. \times 5 ft. 10 in.

JUNIPERUS Linnæus

Evergreen trees or shrubs. Foliage scale-like or needle-like, both forms of leaves being often found on the same plant. Flowers monœcious or dicecious. Male flowers consisting of numerous stamens united into an oblong or ovoid catkin; the female cones composed of 3-8 valvate scales which become united into a berry-like, usually glaucous fruit. About 40 species occurring chiefly in temperate regions.

KEY TO JUNIPERUS

- A. Leaves all needle-shaped or awl-shaped in whorls of three.
- B. Leaves jointed at the base.
- C. Leaves not decurrent on the branchlets. Staminate flowers solitary. Fruit 6-8 mm. in diam.
- D. Leaves with one white stomatic band above.
- E. Leaves 10-15 mm. long, slightly concave above. Fruit globose, bluish black, about 6 mm. in diam. *J. communis*
- EE. Leaves 12-18 mm. long, widely spreading, slender, deeply grooved above. Fruit lobed above, bluish black, 6-8 mm. in diam. *J. rigida*
- DD. Leaves 12-18 mm. long, directed forwards, with two white stomatic bands above. Branchlets drooping. Fruits reddish brown *J. formosana*

- CC. Leaves decurrent. Staminate flowers in clusters of 3-6.
Fruit 18-25 mm. diam.
D. Leaves 12-18 mm. long, rigid, spreading, sharp-pointed. Upper surface with a broad green midrib between two white stomatic bands. *J. drupacea*
- BB. Leaves not jointed at the base.
C. Trees with pendulous branches. Leaves loosely adpressed. Fruit ovoid.
D. Foliage greyish green. Leaves 4-6 mm. long, concave with no green midrib on white upper surface *J. recurva*
- DD. Foliage bluish green. Leaves 7-11 mm. long; upper surface pale with a narrow green midrib *J. Coxi*
- CC. Procumbent or prostrate shrubs. Leaves spreading or loosely adpressed. Fruit ovoid or subglobose.
D. Branchlets green. Leaves 4 mm. long, green on the dorsal surface. Fruit 1 seeded *J. squamata*
- DD. Branchlets glaucous. Leaves 8 mm. long, glaucous on the dorsal surface. Fruit 2-3 seeded *J. procumbens*
- AA. Leaves on adult trees scale-like and adpressed often with awl-shaped foliage on some branchlets.
B. Fruit 8-12 mm. diam., dark purplish brown, glaucous. Seeds 4-6. Leaves greyish green, acute *J. excelsa*
- BB. Fruit 4-6 mm. diam.
C. Trees. Needle-shaped leaves when present in pairs. Scale leaves acute. Fruit with a waxy bloom. Seeds 1-2 *J. virginiana*
- CC. Shrubs or small trees.
D. Foliage dark green, rank scented when bruised. Needle-shaped leaves usually in pairs. Scale-leaves acute or obtuse. Fruit brownish with a waxy bloom, on scaly curved branchlets. Seeds usually 2 *J. Sabina*
- DD. Similar to *J. Sabina*, but foliage less rank scented, bluish green or steel blue. A prostrate shrub *J. horizontalis*
- DDD. Foliage dark green, not rank scented. Needle-shaped leaves in threes. Scale leaves obtuse with pale margins. Fruit on very short curved branchlets with a waxy bloom. Seeds 2-3 *J. chinensis*

Juniperus chinensis Linnæus. Chinese Juniper. China, Mongolia, Japan. (Fig. 45.)

A variable tree attaining a height of 60 ft. Introduced into England in 1804. The handsome male tree is probably the commonest juniper in cultivation. There are many garden forms.

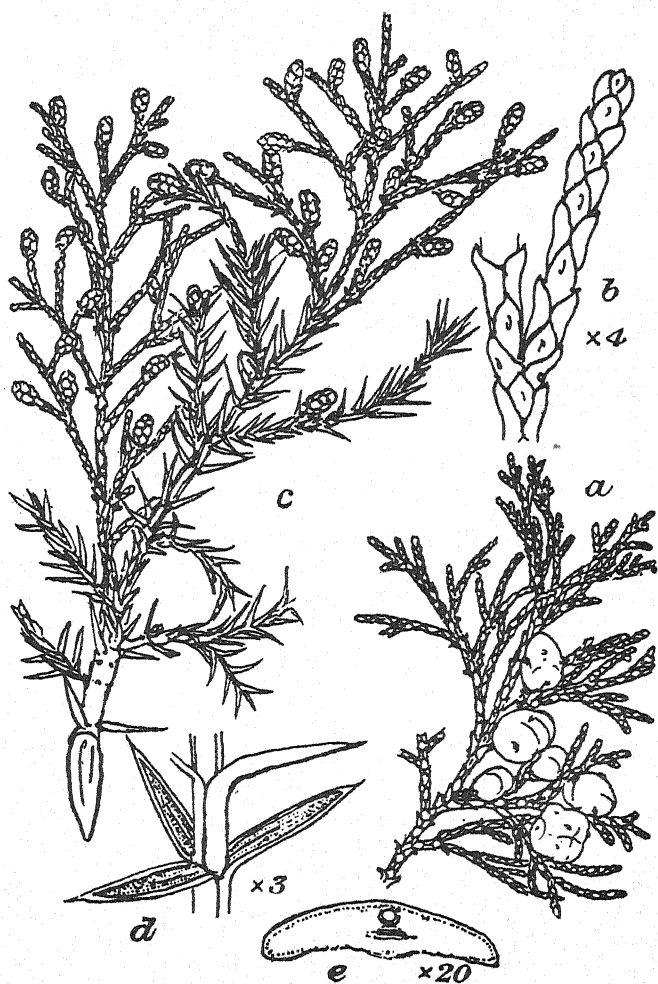


FIG. 45.—*JUNIPERUS CHINENSIS*.

a, spray with scale-like foliage and berries; *b*, branchlet with scale leaves; *c*, spray with both scale- and needle-like foliage and many male cones; *d*, needle leaves in whorls of three; *e*, section of needle leaf.

NOTEWORTHY SPECIMENS :

England. Devon : Bickton, 57 ft. \times 4 ft. 6 in. Wilts. : Bowood, 54 ft. \times 5 ft. 4 in. Glos. : Westonbirt, 53 ft. \times 4 ft. 7 in.

Scotland. Perth : Rossie Priory, 70 ft. \times 8 ft. 10 in.

Juniperus communis Linnæus. Common Juniper. Europe, Asia, N. America.

Shrub or small tree occasionally attaining a height of 40 ft. One of the three indigenous British conifers, and often a characteristic feature of chalk and limestone soils.

Juniperus Coxii A. B. Jackson. Coffin Juniper. Mountains of Upper Burma and Yunnan.

Tree attaining 180 ft. or more in height and 30 ft. in girth. Introduced about 1920. The fragrant timber has long been much in demand by the Chinese for making coffins. It was probably formerly abundant in Yunnan, but is now only found south of the frontier. Faster in growth than *J. recurva*, to which it is nearly allied. It is easily grown from cuttings and is now frequent in cultivation.

NOTEWORTHY SPECIMENS :

England. Hants. : Exbury, 22 ft. (12 ft. in diam.). Sussex : Borde Hill, 17 ft.

Juniperus drupacea Labillardière. Syrian Juniper. Mountains of Asia Minor, Syria and Greece. (Fig. 46.)

Tree attaining a height of 60 ft. or more, of pyramidal or columnar shape. Introduced about 1854. Apparently only male trees are known in this country, where old specimens are seldom seen.

NOTEWORTHY SPECIMENS :

England. Norfolk : Holkham, 47 ft. and 48 ft. Sussex : Leonardslee, 26 ft. Cambridge : Pampisford Hall,

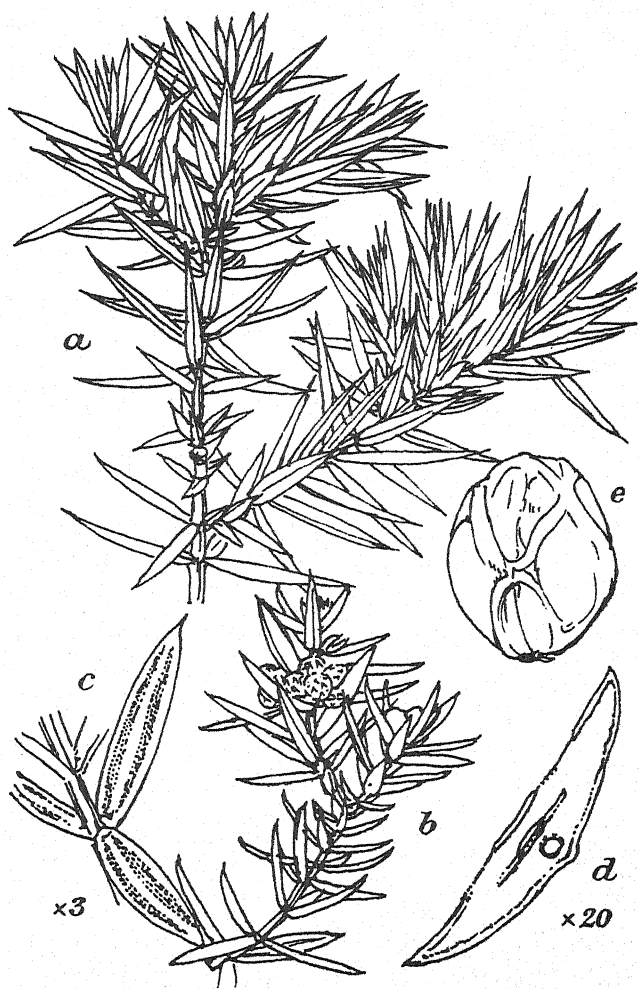


FIG. 46.—*JUNIPERUS DRUPACEA*.

a, spray ; *b*, spray with cluster of male cones ; *c*, whorl of three leaves ;
d, section of leaf ; *e*, berry.

20 ft. Herts. : Brickenden Grange, 47 ft. Cornwall : Lanhydrock, 39 ft. Oxford : Crousley Park, 32 ft.

Juniperus excelsa Bieberstein. S.E. Europe and Asia Minor, Caucasus.

A tree attaining 60 ft. in height, though seldom more than 30 ft. in this country. Introduced in 1836, and not common in cultivation.

NOTEWORTHY SPECIMENS :

England. Gos. : Westonbirt, 44 ft.

Ireland. Co. Dublin : Glasnevin, 37 ft. Co. Wicklow : Powerscourt, 37 ft.

Juniperus formosana Hayata. Mountains of China and Formosa.

A graceful tree attaining a height of 50 ft. or more in China, but only seen as a shrub in this country. Introduced in 1844 by Fortune.

NOTEWORTHY SPECIMEN :

England. Sussex : Borde Hill, 10 ft.

Juniperus horizontalis Moench. Canada and N. United States.

A prostrate glaucous shrub with long trailing branches. Introduced in 1836. Infrequent in cultivation.

Juniperus pachyphlœa Torrey. A native of Arizona, Texas and Mexico.

It is sometimes grown in this country on account of its glaucous, juvenile foliage. The bark is divided into small scaly plates, a unique character in the genus.

Juniperus procumbens Siebold. (Syn. *J. litoralis* Hort. non Maximowicz.) Japan.

Introduced about 1893. A low shrub more commonly cultivated in England than *J. squamata*, from which it differs in its longer, stiffer leaves and glaucous shoots.

Juniperus recurva Buchanan-Hamilton. Eastern Himalaya, S.W. China.

Pyramidal tree attaining 30 to 40 ft. in height. Introduced in 1830. Good specimens are not infrequent in older collections.

NOTEWORTHY SPECIMENS :

England. Wilts. : Bowood, 48 ft. \times 9 ft. Cornwall : Scorrier, 36 ft.

Scotland. Angus : Cortachy Castle, 39 ft. \times 4 ft. Argyll : Inveraray, 31 ft.

Ireland. Co. Leix : Blandford, 34 ft. Co. Down : Castlewellan, 46 ft.

Juniperus rigida Siebold and Zuccarini. Japan, Manchuria and Korea.

Shrub or small tree. Introduced in 1861 by J. G. Veitch. Succeeds best in the south of England. Old trees assume a graceful pyramidal habit with pendulous branchlets.

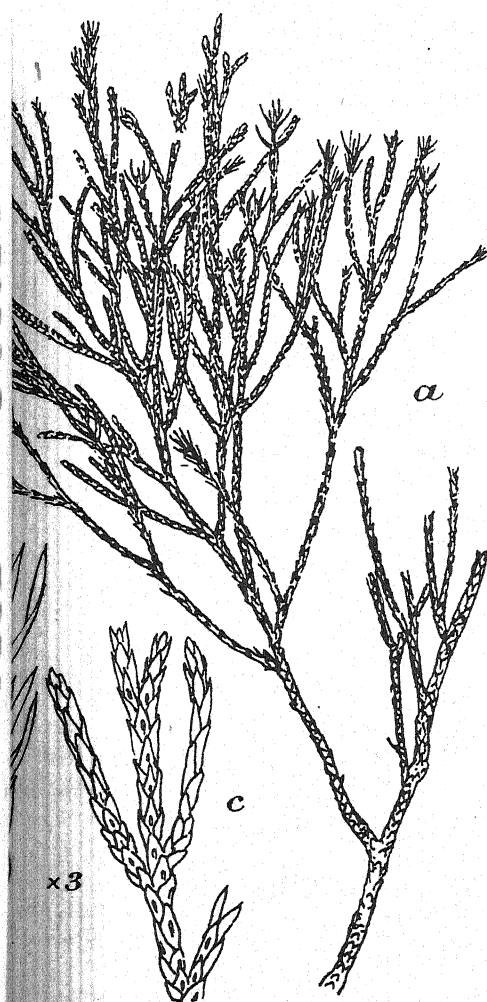
NOTEWORTHY SPECIMENS :

England. Hereford : Hergest Croft, 21 ft. Surrey : Leonardslee, 18 ft. Sussex : Borde Hill, 15 ft.

Juniperus Sabina L. Savin. Central and S. Europe to the Caucasus and N. America.

A shrub rarely attaining the height of 12 ft. Introduced about the middle of the sixteenth century. The

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G. 47.—*JUNIPERUS VIRGINIANA*.
 a, branchlet with scale and needle leaves ; c, branchlet with

prostrate form is often seen in gardens. Oil of Savin is distilled from the leaves and shoots and has powerful medicinal properties.

Juniperus squamata Buchanan-Hamilton. Mountains of Afghanistan, Himalayas and China.

A prostrate shrub or small tree. Introduced about 1836. In habit it resembles dwarf forms of *J. communis*.

Juniperus virginiana Linnæus. Pencil Cedar. Canada to Florida, East of the Rocky Mountains. (Fig. 47.)

A variable tree with ascending or spreading branches. Introduced about 1650 and often met with in old gardens, but less commonly planted recently than *J. chinensis*. Wood fragrant and durable. Formerly much used for the casing of lead pencils.

NOTEWORTHY SPECIMENS :

England. Worcester : Hewell Grange, 62 ft. \times 6 ft.
Yorks. : Studley Royal, 60 ft. \times 6 ft. 7 in. *Sussex* :
Beauport, 55 ft. ; Goodwood, 52 ft. *Staffs.* :
Patshull, 53 ft. 6 in. *Cornwall* : Heligan, 47 ft.
Glos. : Westonbirt, 48 ft.

GINKGOACEÆ

GINKGO Linnaeus

A monotypic genus differing chiefly from the Coniferae, among which it was formerly placed by the ovules being fertilised by motile sperm cells conveyed to them by the pollen tubes. Leaves fan-shaped. Flowers dioecious, the staminate catkin-like. Fruit drupe-like, orange yellow, the woody shell surrounded by a pulpy rank-smelling outer coat.

Ginkgo biloba Linnaeus. Maidenhair Tree. Probably a native of eastern China, though not certainly known, now in a wild state. Abundantly planted throughout China and Japan. (Fig. 48.)

Tree attaining 120 ft. in height and 18–20 ft. in girth. Introduced into England in 1754. A tree of great decorative value. Only a few female trees have been recorded from this country.¹ In 1922 a tree at Bath produced a good crop of fruit and has continued to do so in succeeding years, but the seeds have not proved fertile.

NOTEWORTHY SPECIMENS :

England. Kent: Linton Park, 80 ft. \times 6 ft. Hereford: Whitfield, 75 ft. \times 11 ft. Surrey: Kew Gardens, 73 ft. \times 12 ft.; Knaphill, 71 ft. Cornwall: Carclew, 73 ft. \times 7 ft. 5 in.; Enys, 70 ft. Middlesex: Chiswick House, 60 ft. \times 8 ft. Essex: "Lillies," Wanstead, 24 ft. \times 5 ft., with 48 ft. spread of branches. Blaise Castle, Bristol: 78 ft. \times 12 ft.

¹ See Cahen's paper, "Ginkgo through the Ages," *Journ. R. Hort. Soc.*, LXVIII, 99 (1943).

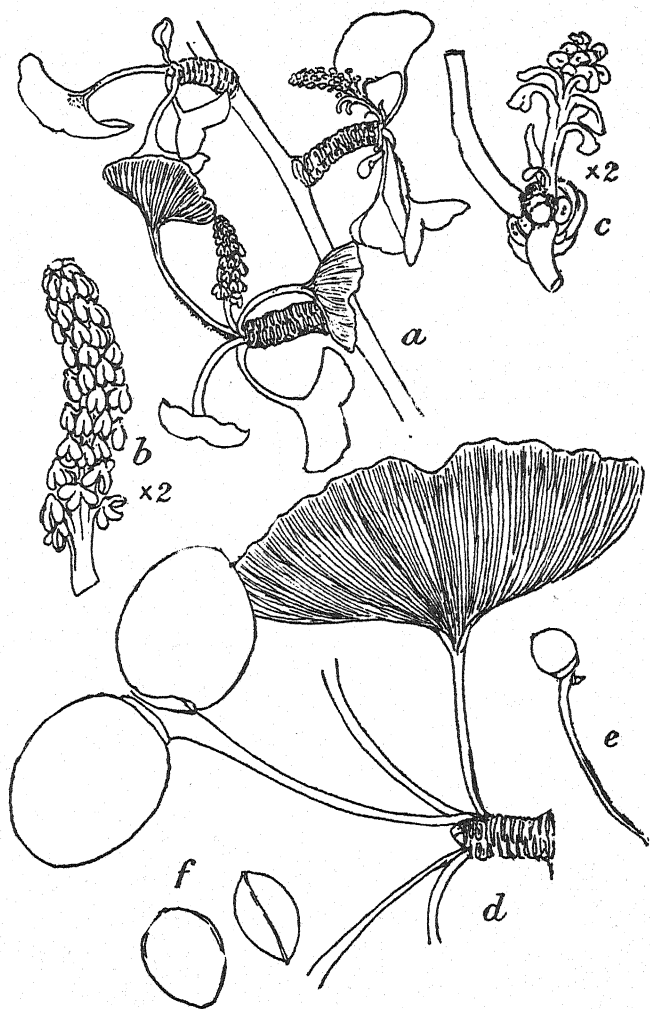


FIG. 48.—*GINKGO BILOBA*.

a, spray with young leaves and stamen catkins; *b*, *c*, male catkin; in *c* the lower stamens are transformed into small leaflets; *d*, shoot with leaf and two ripe fruits; *e*, young fruit and unfertilized ovule; *f*, stone of fruit in two aspects.

INDEX

Names of species are printed in italics; synonyms are in roman.

- Abies*, 8, 22
 „ *alba*, 24, 25
 „ *amabilis*, 24, 25
 „ *balsamea*, 24, 25
 „ *brachyphylla*, 24, 31
 „ *bracteata*, 23, 40
 „ *brevifolia*, 39
 „ *cephalonica*, 23, 28
 „ *cilicica*, 24, 28
 „ *concolor*, 23, 28
 „ „ var. *Lowiana*, 33
 „ *Delavayi*, 23, 29
 „ „ var. *Forrestii*, 29
 „ *Fabri*, 29
 „ *Fargesii*, 23, 30
 „ *Faxoniana*, 29
 „ *firma*, 23, 30
 „ *Forrestii*, 29
 „ *Fraseri*, 24, 30
 „ *Gamblei*, 31
 „ *grandis*, 23, 31
 „ *homolepis*, 24, 31
 „ Key to, 23
 „ *koreana*, 24, 33
 „ *lasiocarpa*, 24, 33
 „ *Lowiana*, 23, 33
 „ *magnifica*, 23, 34
 „ *Mariesii*, 24, 34
 „ *nobilis*, 23, 35
 „ *Nordmanniana*, 24, 35
 „ *numidica*, 24, 35
 „ *pectinata*, 24, 25
 „ *Pindrow*, 24, 37
 „ „ var. *brevifolia*, 31
 „ *Pinsapo*, 23, 37
 „ *sachalinensis*, 24, 37
 „ *sibirica*, 24, 39
 „ *spectabilis*, 23, 39
 „ „ var. *brevifolia*, 39
 „ *squamata*, 40
 „ *subalpina*, 33
 „ *sutchuenensis*, 30
 „ *Veitchii*, 24, 40
 „ *venusta*, 23, 40
 „ *Webbiana*, 23, 39
- Abietineæ*, 5
Araucaria, 114
 „ *araucana*, 10, 115
 „ *excelsa*, 10, 115
 „ *imbricata*, 115
Araucarineæ, 6
Arbor-vitæ, Chinese, 134
 „ Giant, 134
Athrotaxis, 10, 107
 „ *cupressoides*, 109
 „ *latifolia*, 109
 „ *selaginoides*, 109
- Balm of Gilead, 25
 Buds and Young Shoots, 1
- California Nutmeg, 13
Cedar, Atlas, 90
 „ Incense, 131
 „ Japanese, 103
 „ Lebanon, 91
 „ Pencil, 145
 „ Red, 134
Cedrus, 8, 88
 „ *atlantica*, 90
 „ „ var. *glauca*, 90
 „ *brevifolia*, 90
 „ *Deodara*, 91
 „ *Libani*, 91
Cephalotaxus, 9, 11
 „ *drupacea*, 11
 „ *Fortunei*, 11
 „ „ var. *pedunculata*, 11
- Chamæcyparis formosensis*, 119
 „ *Lawsoniana*, 120
 „ *nootkatensis*, 124
 „ *obtusa*, 126
 „ *pisifera*, 126
 „ *thyoides*, 128
Chermes Strobi, 30
Conifers, Keys for Identification, 3
 „ Scent of, 7
Cronartium rubicolum, 30

- Cryptomeria* 108
 „ *japonica*, 10, 108
 „ „ var. *elegans*, 108
Cunninghamia, 9, 101
 „ *Konishii*, 108
 „ *lanceolata*, 108
 „ *sinensis*, 108
Cupressaceæ, 6, 116
Cupressus, 9, 10, 116
 „ *arizonica* var. *bonita*, 119
 „ *Duclouxiana*, 128
 „ *formosensis*, 118, 119
 „ *funbris*, 118, 120
 „ *glabra*, 119
 „ *Goveniana*, 119, 120
 „ Key to, 118
 „ *Lawsoniana*, 118, 120
 „ *Leylandii*, 124
 „ *lusitanica*, 119, 122
 „ „ var. *Benthami*, 118, 122
 „ *Macnabiana*, 119, 122
 „ *macrocarpa*, 119, 122
 „ *nootkatensis*, 118, 124
 „ *obtusa*, 118, 126
 „ *pisifera*, 118, 126
 „ „ var. *plumosa*, 126
 „ „ var. *plumosa aurea*, 126
 „ „ var. *squarrosa*, 126
 „ *sempervirens*, 119, 128
 „ *thyoides*, 118, 128
 „ *torulosa*, 118, 129
Cypress, Chinese Weeping, 120
 „ Deciduous, 111
 „ Himalayan, 129
 „ Hinoki, 126
 „ Hybrid, 124
 „ Knees, 114
 „ Mediterranean, 128
 „ Mexican, 122
 „ Monterey, 122
 „ Sawara, 126
 „ White, 128
 „ Yellow, 124
Dacrydium Franklini, 11
Deodar, 91
Douglas Fir, Colorado, 95
 „ „ Japanese, 95
 „ „ Oregon, 98
Fir, Algerian, 85
 „ Bristle-cone, 40
 „ Caucasian, 85
 „ Chinese Silver, 29
 „ Colorado Douglas, 95
 „ Douglas, 93, 95
 „ European Silver, 25
 „ Giant, 81
 „ Greek, 28
 „ Oregon Douglas, 98
 „ Red, 8, 84
 „ Scotch, 80
 „ Spanish, 87
Fitzroya, 10, 116
 „ *cupressoides*, 116
 „ *patagonica*, 116
 Flowers, 2
 Foliage, 1
Ginkgo biloba, 146
Ginkgoaceæ, 146
Hemlock, Carolina, 9
 „ Chinese, 97
 „ Eastern, 97
 „ Mountain, 100
 „ Northern Japanese, 99
 „ Southern Japanese, 101
 „ Western, 100
Juniper, Chinese, 188
 „ Coffin, 140
 „ Common, 140
 „ Pencil, 145
 „ Syrian, 140
Juniperus, 9, 10, 137
 „ *chinensis*, 188
 „ *communis*, 187, 140
 „ *Coxii*, 188, 140
 „ *drupacea*, 188, 140
 „ *excelsa*, 188, 142
 „ *formosana*, 187, 142
 „ *horizontalis*, 188, 142
 „ *litoralis*, 143
 „ *pachyphlœa*, 142
 „ *procumbens*, 188, 143
 „ *recurva*, 188, 143
 „ *rigida*, 187, 143
 „ *Sabina*, 188, 143
 „ *squamata*, 188, 145
 „ *virginiana*, 188, 145
Keteleeria, 9, 41
 „ *Davidiana*, 41
 Knotty Disease, 25

- Larch, Chinese, 88
 " Common, 84
 " Dahurian, 86
 " Golden, 88
 " Hybrid, 84
 " Japanese, 87
 " Olga Bay, 86
 " Sikkim, 86
 " Western, 87
Larix, 8, 83
 " *americana*, 83, 86
 " *dahurica*, 86
 " " var. *Principis Rupprechtii*, 86
 " *decidua*, 83, 84
 " *europæis*, 84
 " *europæa*, 83, 84
 " *Gmelini*, 83, 86
 " *Griffithii*, 83, 86
 " *Kämpferi*, 87
 " *kurilensis*, 86
 " *laricina*, 83, 86
 " *leptolepis*, 83, 87
 " *occidentalis*, 83, 87
 " *olgensis*, 86
 " *pendula*, 84
 " *Potanini*, 83, 88
 " *Principis Rupprechtii*, 86
 " *thibetica*, 88
Libocedrus, 9, 129
 " *chilensis*, 129
 " *decurrens*, 129, 131
 Maidenhair Tree, 146
 Monkey Puzzle, 115
Picea, 8, 41
 " *Abies*, 43
 " *ajanensis*, 47
 " *alba*, 43, 47
 " *ascendens*, 46
 " *asperata*, 42, 45
 " *aurantiaca*, 45
 " *Balfouriana*, 48
 " *bicolor*, 42, 45
 " *brachystyla*, 42, 46
 " *Breweriana*, 42, 46
 " *complanata*, 46
 " *Engelmanni*, 43, 46
 " *excelsa*, 43
 " *gemmata*, 45
 " *glauca*, 43, 47
 " *Glehnii*, 43, 47
 " *heterolepis*, 45
Picea, *jezoensis*, 42, 47
 " " var. *hondoensis*, 47
 " Key to, 42
 " *Koyamai*, 43, 48
 " *likiangensis*, 42, 48
 " " var. *purpurea*, 48
 " *mariana*, 43, 48
 " *Maximowiczii*, 42, 50
 " *montigena*, 48
 " *Morinda*, 42, 53
 " *morindoides*, 42, 55
 " *Neoveitchii*, 45
 " *nigra*, 43, 48
 " *Omorika*, 42, 50
 " *orientalis*, 43, 50
 " *polita*, 42, 52
 " *pungens*, 42, 52
 " " var. *glauca*, 52
 " *purpurea*, 48
 " *rubens*, 43, 52
 " *rubra*, 43, 52
 " *Sargentiana*, 46
 " *Schrenkiana*, 42, 53
 " *sitchensis*, 42, 53
 " *Smithiana*, 42, 53
 " *spinulosa*, 42, 55
 " *Watsoniana*, 55
 " *Wilsonii*, 43, 55
Pinaceæ, 5, 22
Pine, *Arolla*, 61
 " Austrian, 69
 " Bhutan, 83
 " Big-cone, 64
 " Bishop's, 69
 " Bristle-cone, 59
 " Chile, 115
 " Chinese, 82
 " Cluster, 74
 " Corsican, 71
 " Crimean, 71
 " Digger, 78
 " Huon, 11
 " Jack, 60
 " Japanese White, 71
 " King William, 109
 " Knob-cone, 59
 " Lace-bark, 60
 " Limber, 64
 " Macedonian, 72
 " Mexican White, 60
 " Monterey, 76
 " Norfolk Island, 115
 " Northern Pitch, 78
 " Scots, 80

- Pine, Shore, 61
 " Stone, 74
 " Sugar, 65
 " Umbrella, 111
 " Western White, 67
 " Western Yellow, 76
 " Weymouth, 78
Pinus, 8, 55
 " *aristata*, 56, 59
 " *Armandi*, 56, 59
 " *attenuata*, 57, 59
 " *Azacahuatl*, 56, 60
 " *Banksiana*, 58, 60
 " *Bungeana*, 57, 60
 " *Cembra*, 56, 61
 " *contorta*, 58, 61
 " " var. *Murrayana*, 61
 " *Coulteri*, 57, 64
 " *densiflora*, 58, 64
 " *excelsa*, 56, 83
 " *flexilis*, 57, 64
 " *Holfordiana*, 56, 65
 " *insignis*, 57, 76
 " Key to, 56
 " *koraicensis*, 56, 65
 " *Lambertiana*, 57, 65
 " *Laricio*, 58, 69
 " " var. *austriaca*, 69
 " " var. *corsicana*, 71
 " " var. *tenuifolia*, 71
 " *leucodermis*, 58, 66
 " *Massoniana*, 82
 " *montana*, 58, 67
 " *Montezumæ*, 56, 66
 " " var. *Hartwegii*, 66
 " *monticola*, 57, 67
 " *Mugo*, 58, 67
 " " " *rostrata*, 69
 " " " *rotundata*, 69
 " *muricata*, 58, 69
 " *nigra*, 58, 69
 " " var. *calabrica*, 58, 71
 " " var. *caramanica*, 71
 " " var. *cebennensis*, 71
 " " var. *Pallasiana*, 71
 " *parviflora*, 57, 71
 " *patula*, 57, 72
 " *peuce*, 56, 72
 " *Pinaster*, 58, 74
 " *Pinea*, 58, 74
 " *ponderosa*, 57, 76
 " " var. *Jeffreyi*, 57, 76
 " " " *pumila*, 57
 " *pyrenaica*, 71
 " *radiata*, 57, 76
 " *rigida*, 57, 78
 " *Sabiniana*, 57, 78
 " *sinensis*, 58, 82
 " *Strobus*, 57, 78
 " *syloestris*, 58, 80
 " *tabuliformis*, 58, 82
 " " var. *yunnanensis*, 82
 " *Thunbergi*, 58, 82
 " *tuberculata*, 57, 59
 " *Wallichiana*, 56, 83
 " *yunnanensis*, 82
Podocarpæ, 5
Podocarpus alpinus, 9, 17
 " *andinus*, 9, 17
 " *chilinus*, 19
 " *salignus*, 9, 19
Prumnopitys elegans, 17
Pseudolarix, 8, 88
 " *amabilis*, 88
 " *Fortunei*, 88
Pseudotsuga, 8, 93
 " *Douglasii*, 93
 " " var. *glauca*, 95
 " *glauca*, 93, 95
 " *japonica*, 95
 " *taxifolia*, 93
 Redwood, 105
Retinispora plumosa, 126
 Savin, 143
Saxegothaea, 9, 19
 " *conspicua*, 19
Sciadopitys, 8, 111
 " *verticillata*, 111
 Seedling plant, 1
Sequoia, 105
 " *gigantea*, 107
 " *sempervirens*, 9, 105
 " *Wellingtonia*, 10, 107
 Spruce, Alcock's, 45
 " Black, 43
 " Brewer's Weeping, 46
 " Common, 43
 " Hemlock, 96
 " Hondo, 47
 " Oriental, 50
 " Servian, 50
 " Sikkim, 53
 " Sitka, 53

- | | |
|----------------------------------|---------------------------------|
| Spruce, Tigertail, 52 | <i>Torreya</i> , 9, 18 |
| " White, 47 | " <i>californica</i> , 18 |
| Stomata, 2 | " <i>grandis</i> , 15 |
| | " <i>nucifera</i> , 18 |
| Tamarack, 86 | <i>Tsuga</i> , 8, 96 |
| Taxaceæ, 4 | " Albertiana, 100 |
| Taxus, 4 | " Brunoniana, 96, 99 |
| Taxodineæ, 6 | " <i>canadensis</i> , 96, 97 |
| <i>Taxodium</i> , 9, 111 | " <i>caroliniana</i> , 96, 97 |
| " <i>ascendens</i> , 114 | " <i>chinensis</i> , 96, 97 |
| " <i>distichum</i> , 111 | " <i>diversifolia</i> , 96, 99 |
| " " var. <i>imbricatum</i> , 114 | " <i>dumosa</i> , 96, 99 |
| | " <i>heterophylla</i> , 96, 100 |
| <i>Taxus</i> , 9, 15 | " Hookeriana, 100 |
| " <i>baccata</i> , 15 | " <i>Jeffreyi</i> , 97, 100 |
| " " var. <i>adpressa</i> , 15 | " Key to, 96 |
| " " var. <i>fastigiata</i> , 15 | " <i>Mertensiana</i> , 97, 100 |
| " <i>cuspidata</i> , 17 | " Pattoniana, 97, 100 |
| " Harringtoniana, 11 | " <i>Sieboldii</i> , 96, 101 |
| <i>Thuja</i> , 9, 181 | " <i>yunnanensis</i> , 99 |
| " <i>dolabrata</i> , 182 | <i>Wellingtonia</i> , 107 |
| " <i>japonica</i> , 182, 187 | Weymouth Pine Aphis, 80 |
| " <i>koraensis</i> , 182, 187 | " " Rust, 67, 80 |
| " <i>Lobbii</i> , 182, 184 | Wood, 2 |
| " <i>occidentalis</i> , 182, 184 | |
| " <i>orientalis</i> , 182, 184 | Yew, Common, 15 |
| " <i>plicata</i> , 182, 184 | " Plum-fruited, 17 |
| " <i>Standishii</i> , 182, 187 | " Prince Albert's, 19 |
| <i>Thujopsis dolabrata</i> , 182 | |